











TRANSACTIONS

OF THE

SIXTEENTH ANNUAL MEETING

OF THE

American  
Academy of Ophthalmology  
and Oto-Laryngology



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SEPT. 25, 26, 27, 1911



The Seventeenth Annual Meeting of the American Academy  
of Ophthalmology and Oto-Laryngology will be held at Niagara  
Falls, Ontario, August 20, 21, 22, 1912.

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# PRESIDENT'S ADDRESS

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## SOME OBSERVATIONS UPON THE CRIBRIFORM PLATE AND OLFACTORY NERVE IN MAN AND CERTAIN ANIMALS.

JOHN J. KYLE, M. D.,

INDIANAPOLIS, INDIANA.

For convenience, I have divided my address into two parts: the first will be personal and relate to the society, and the second, more prosy and scientific in character. The title of my scientific paper is, "Some Observations Upon the Cribriform Plate and Olfactory Nerve in Man and Certain Animals." I have no knowledge as to the general interest of this subject, but to me the study has been a source of pleasure, though it may appear somewhat disjointed, and, unfortunately, at this time is incomplete. However, I lay no claim to being a biologist or naturalist, but only an interested observer of the animal life about us.

My first privilege, as a citizen, is to welcome the members of this Association and our distinguished guest to the city of Indianapolis. I am sure I voice the sentiment of the local profession when I tell you we are glad to have you with us, and hope the memory of your visit here will ever be a stimulant for pleasant reminiscences.

My second privilege and honor, as your president, is that of thanking the members for their courtesy in electing me president of this Academy for the year just drawing to a close, and it is my sincere wish that my successor may enjoy the office and its pleasant associations as much as I have.

We are especially honored today in having with us Dr. Albert A. Gray, a man eminent in our specialty, and we sincerely hope his visit with us will be a happy one and that he may return to his home with the conviction that the American otologists and laryngologists hold their British conferees at the pinnacle of their affection.

The founders of this society had in mind the organization of the reputable specialists of the entire North American continent into one mighty association. Dr. Reber, in his address before



this society last year, recommended an amendment to our constitution, admitting to full membership Canadians and Latin Americans, imposing, however, the same restrictions as those imposed upon our own countrymen. This amendment has been voted upon today.

Our society still remains the largest of its kind in the world and as long as we maintain the spirit of its founders, it must continue to grow, exercising an important part in the development of the science of ophthalmology and oto-laryngology. No active effort has been made to secure new members, but I feel that with the amendment of our constitution, hundreds of good men, ambitious and worthy of membership, only awaiting an invitation, will affiliate with us.

My conception of the interest of our members and the sincerity of their purpose to advance the scientific and democratic spirit of this society has been greatly intensified since coming into office. I have received letters from all sections of the country, offering hearty coöperation in promoting every interest of the society. There is, however, an unusual modesty on the part of the members when it comes to volunteering papers for the scientific program. The members should remember that worthy contributions are gladly received by the program committee. A glance at the program today will convince all that an exceedingly interesting list of papers is presented. The presiding officer is grateful to those who have given so much time to their preparation for our edification.

The subject of editing and publishing a year book of ophthalmology and oto-laryngology is also to come up today before the society. This field of literature is now filled, I think, by the monthly publication of the *Index of Ophthalmology*, edited by Dr. Edward Jackson, and the *Index of Oto-Laryngology*, edited by Dr. Joseph Beck, both of whom are members of this society. Though these two publications are private undertakings, the necessity of such reviews was first manifested in this society a number of years ago, from which demand they were evolved. As a society, I think we should commend the work of Dr. Jackson and Dr. Beck, and as individuals, do all we can to encourage them in their undertaking. In this day we seldom find men who are willing to work for the good of all and without hope of commensurate monetary reward. In addition to these publications, the *Laryngoscope* and the *Annals of Otology, Rhinology and Laryngology*, both endeavor to supply excerpts of

important publications. Under the circumstances, whether or not it is advisable to assume this new undertaking at this time, is a matter to be determined by the society.

The society has, through the efforts of our vice-president, Dr. Lewis, continued its interest in social and economic subjects. Dr. Lewis represented the society during the past year at a general conference for the prevention of blindness, and following that conference, Dr. Weeks, Dr. Reber and Dr. Green were recommended by the president to represent the Academy, in an advisory capacity, anticipating the formation of a national society for the prevention of blindness. Dr. Max Goldstein was appointed an official representative to the Third International Congress of Laryngology and Rhinology, which convened in Berlin, August 30th.

During the year we have lost by death Dr. Herman Knapp, an honorary member of the society, Dr. Clarence W. Heath, Dr. Laertus Connor, Dr. Frank M. Koyle, Dr. Harry J. Dean, Dr. Albert R. Baker, Dr. Alvin A. Hubbell and Dr. John F. Byington, each of whom played a conspicuous part in the progress of the society, and the memory of their activities and good-fellowship will long remain with us. Professor Schwartz was not a member of this society, yet it should be said that his death removed from the field of otology a rugged pioneer of science and a man who has contributed much to the individual success of many of us, in the realm of aural surgery. The same encomium may be paid to Professor Lucae, who was considered the *doyen* of German otologists, and who shortly after followed Professor Schwartz to his well-earned rest.

#### SOME OBSERVATIONS UPON THE CRIBRIFORM PLATE AND OLFACTORY NERVE IN MAN AND CERTAIN ANIMALS.

In the consideration of the subject of the cribriform plate and olfactory nerve of vertebrates, I shall briefly discuss the anatomy and function of these structures as observed in the study of the fish, frog, reptile, bird and mammals. Under the heading of mammals, I shall confine my observations to man and certain well-known types of herbivorous and carnivorous animals.

Dr. J. M. Ingersol, of Cleveland, and Dr. Joseph Beck, of Chicago, have added valuable information to our knowledge of the comparative anatomy of animals, the former through study of the turbinates, and the latter, the sinuses and mastoid



process. Our guest of today has contributed extensively to the study of the labyrinth, and Dr. Casey A. Wood, of Chicago, has collected a great amount of information relative to the eyes of certain animals. There is yet much valuable information in comparative anatomy of the eye, ear, nose and throat to be collected, which, when once compiled, will be interesting and extremely valuable.

In man and animals, the sense of smell is governed, relatively speaking, by the size of the cribriform plate and olfactory and respiratory turbinates. Environment has a great deal to do with the acuteness of the sense of smell and with each change in environment, there is a corresponding change in this sense, commensurate with the necessities of the individual. In the ascent of man there has been a general progressive loss of the sense of smell, which is directly traceable to his indoor life and constant exposure to the evil effects of bad ventilation and superheated rooms, predisposing him to diseases of the nasal cavity and structural changes in the olfactory and turbinal mucosa, with a corresponding loss of the sense of smell. Men who inhabit the fastnesses of the forest or the open plains possess a much higher olfactory sense than those who are compelled to live in towns and cities. Animals in captivity probably suffer a proportionate loss. An acute sense of smell can only come by a life in the open.

Monkeys do not possess the acute sense of smell possessed by most quadrupeds, the cribriform plate being seen as a small, narrow slit on either side of the crista galli.

In the wild carnivora the sense of smell is most acute, for this is essentially the important factor in self-preservation. In this class of vertebrates the olfactory nerve and cribriform plate are highly developed. In the higher types, other senses become developed, relieving the olfactory organ of much of its early function, but with a corresponding loss of acuteness.

In the tiger, wolf and dog the sense of smell is a more important factor in the chase than sight and hearing. The vision of the dog, for instance, is much less highly developed than his smelling capacity.

The cribriform plate, with its various number of perforations, is always present in both the carnivora and herbivora, and, in fact, in all mammals a want of development is the exception. In some of the lower mammals the nerve enters the skull via one opening. This, however, is exceptional.

The olfactory acuteness may be said to be in proportion to the distribution of the olfactory nerve to the nasal mucosa. In some animals and man the sense of smell is highly developed for special odors. Certain carnivora restrict their diet to a few articles of food and deliver their attack only in a particular manner. They do not comprehend, or if they comprehend, they ignore those substances unnecessary to their sustenance. For instance, the weasel differs from the great cat tribe in that its sense of smell is not restricted and consequently it kills everything and anything in its power, while the feline, whose sense of smell is highly developed in one direction and very much restricted in others, kills only for sustenance.

The olfactory nerve in birds varies greatly in size and termination, the nerve passing through a single opening to the nasal cavity. In all birds, with the exception of the apteryx, a bird found in New Zealand, there is only one opening through the bone which corresponds to the cribriform plate in mammals, and the size of the opening and the distribution of the nerve to the nasal mucosa is, as in other vertebrates, in proportion to their necessity. In the vulture, for example, "the size of the olfactory nerve is about four times greater than observed in the turkey" (Owen). In the turkey the nerve ramifies upon the middle turbinate, whereas in the vulture the nerve is distributed to the upper and middle turbinals and septum. The sense of smell in the vulture, from the wide distribution of the nerve, is thus far greater than in the turkey. It is probably true that in most birds the sense of smell is subservient to vision, but carrion-eating birds have sight as well as smell highly specialized.

I am able to show today slides of one or two birds which will give a very good idea of the variation in the size of the opening in the ethmoidal bone.

The olfactory nerve in frogs and reptilia is much like that observed in birds, in that the nerve has only one opening for passage into the skull to the fore-brain. In the reptile the peripheral ending of the nerve is upon the so-called middle turbinate, which is found upon the lower wall of the intranasal chamber. Generally speaking, there exists in the reptile two nasal chambers, the outer and the inner.

In the examination of the crocodile and snake skulls, which I shall show today, a single turbinal will be seen. The course of the nerve fibers over the middle turbinal to the olfactory bulb can be easily differentiated in the crocodile, which is a higher



type of reptile. In the crocodile, the region of the nose above the bridge of bone supporting the vomer, is known as the olfactory region, and that portion below, as the respiratory region.

In discussing the olfactory nerve of man, I want to briefly review a paper by Effie A. Reed, published in the *American Journal of Anatomy*, Vol. VIII, 1908, and I shall also show some slides taken from this article, which will correct some of our former wrong impressions relative to the size and distribution of the olfactory nerve to the nasal mucosa.

There is a paucity of knowledge relative to the cribriform plate and olfactory nerve in man. Certain general statements are set forth in text books on anatomy and books relating to our specialty, in regard to the distribution of the olfactory nerve, which, however, convey little definite information. Since in all vertebrates the olfactory nerve and its distribution are much alike, this will be the only reference to the minute anatomy that I shall make.

By the olfactory nerve we mean the sensory nerve fibers which connect the nasal mucosa with the olfactory bulb. The olfactory area in man was described by Scarpa as covering the entire upper turbinals, some of the fibers even extending to the middle turbinal and septum. Some of the fibers of the septum were depicted as reaching to the floor of the nose. Other anatomists have described the nerve as occupying a small portion of the upper turbinate and likewise a small portion of the septum adjacent to the cribriform plate. According to Reed, "the olfactory nerve covers the entire superior turbinate, reaching nearly to its free edge to about three-quarters the width of the lower wall and occupying about one-half of the septum."

The extent of the olfactory epithelium is far greater in certain animals than in man. Observation of the structure of the ethmoturbinal in the tiger, for example, as shown by the accompanying picture, will clearly demonstrate that the ethmoturbinal springs from the cribriform plate and grows solely to the attachment of the olfactory nerve, as it were. Other illustrations of different animals will show clearly this same analogy as shown by animals that live by their sense of smell.

In many text-books on anatomy, as well as those relating to our specialty, we find illustrations showing the complete anastomosis of the nerve fibers going to the olfactory bulb. Sometimes we read in the text-books that such an anastomosis of the nerve fibers really exists. Other writers leave us in doubt and say

the nerve fibers lead to the olfactory bulb. Dr. Lennox Brown comes as near as any authority I have observed among specialists in giving a correct description of the anatomy of the nerve, and says that the nerve "consists of about twenty-five olfactory threads from the under surface of the olfactory bulb, these descend to the nose, sheathed in the processes of the dura mater through the foramina in the cribriform plate. The greater number of these filaments pass through an outer row of perforations; fewer through the inner row. The fibers of the outer row are divided into two sets—the posterior going to the upper turbinal, and the anterior to the anterior part of the olfactory groove; while others are distributed to the roof. The nerves form a close net-work on the bones, and branches proceed to end in the olfactory mucous membrane."

It would be better and more accurate, from my observation, to describe the olfactory nerves as covering the roof, the upper third of the septum, the superior turbinate to its free edge and the anterior superior half of the middle turbinate, terminating, for the most part, in the region of the olfactory cleft.

The old anatomist, Scarpa, gave a nearly accurate picture of the arrangement of the nerve fibers as they spread out over the turbinal body and septum.

The anastomosis and net-work arrangement, as described by Brown and others, is more apparent than real. The apparent anastomosis of the nerve fibers, as described by most anatomists and writers, is a crossing and recrossing of nerve fibers, as can be seen in the illustrations. The plexiform appearance, or net-work, is due to ramification of blood vessels, according to Reed, and connective tissue which surrounds those vessels and nerves.

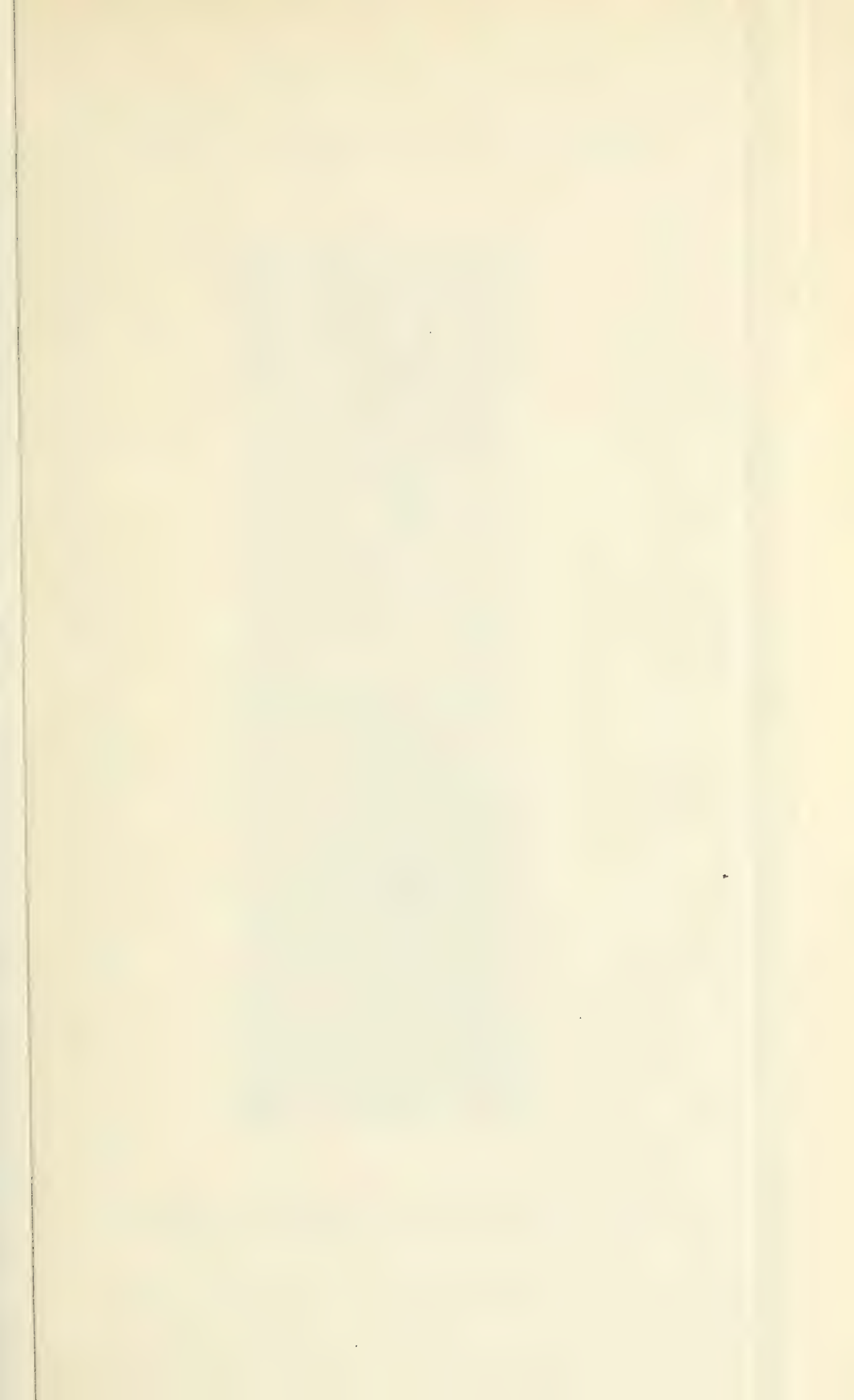
I also find that some of our modern writers describe the pituitary sinus as possessing olfactory nerves and function. These assertions are contradicted by Reed and others. In opening the sinus no regard should be paid to this non-existing function. The ledge of bone representing the superior turbinated body only should be preserved, provided one cares to keep intact the olfactory sense. The peripheral ending of the olfactory nerve, as well as the olfactory hairs, which extend into the nasal cavity, runs directly to the olfactory bulb. The olfactory hairs resemble in function the rods and cones of the retina or the terminal or outer hair cells of the cochlear nerve, and when once destroyed are never reproduced.



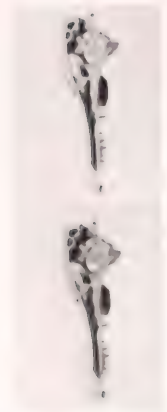
It is reasonable to presume that the olfactory cells can be destroyed by suppuration or pressure in the olfactory region of the nose, and if they are all destroyed anosmia results. Anosmia, by way of discussion, may also result from traumatism to the olfactory axone or lesion of the bulb or sense centers. I think we should be very careful in the application of irritating substances to the olfactory region of the nose, for traumatism is very liable to destroy some of the sensory hair cell.

In conclusion, I wish to apologize for being unable to present a more complete analysis of my subject and for making no reference, through lack of time, to the vomeronasal, or Jacobson's organ.

226 Newton Claypool Building.













## THE PROBLEM OF OTOSCLEROSIS AND ALLIED CONDITIONS.\*

DR. ALBERT GRAY.

GLASGOW.

MR. PRESIDENT, LADIES AND GENTLEMEN:

When I received the invitation of this Academy to give the anniversary address at the Annual Meeting, I need hardly say how highly I appreciated the honor, and what a pleasure it was to me to receive it. To enjoy the recognition of one's colleagues is to receive the most gratifying stimulus which, as men engaged in the pursuit of medical science, we can expect. And when this recognition took the form of inviting me to come so far to address you, it evokes in me a sense of gratitude and of fellowship which I find it very difficult to express in words.

But in addition to the honor, your kindness has also given me the opportunity of seeing my colleagues in this country, and allowing me to meet in friendly gathering many who have only been known to me hitherto by their names and their work. Of the value of such intercourse it is impossible to speak too highly, and for the opportunities you have thus afforded me as well as the high honor you have conferred upon me, I beg you to accept my most grateful thanks.

In choosing the otosclerosis question for the subject of my address, I was fully aware of the fact that a discourse upon the disease in all its bearings would be too long to be included in the time at my disposal. On consideration I came to the conclusion that, for the present purpose, perhaps the two most interesting aspects of the subject would be, first, the anatomical changes that occur; and, second, the relationship which hereditary tendency bears to the disease.

I will proceed at once, therefore, to give a very short description of the pathological conditions which are actually, or have been considered to be characteristic of the disease. And here, at the very outset of the subject, we are met with by the question, What is the first change that occurs? This has been answered by different authorities in three different ways. First, there are those, represented by Habermann and Katz, who main-

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\* Anniversary address delivered upon invitation.

tain that in the first place the middle ear is affected, and that subsequently the bony transformation in the capsule of the labyrinth follows as a result of the inflammatory activity in the middle ear. A second group of investigators hold that the disease is primarily of nervous origin, the first change being in the nerve-structures of the labyrinth, or of the auditory nerve and its ganglionic connections. According to these observers also, the bony change in the capsule of the labyrinth is a secondary process. The third, and largest group of investigators, are of the opinion

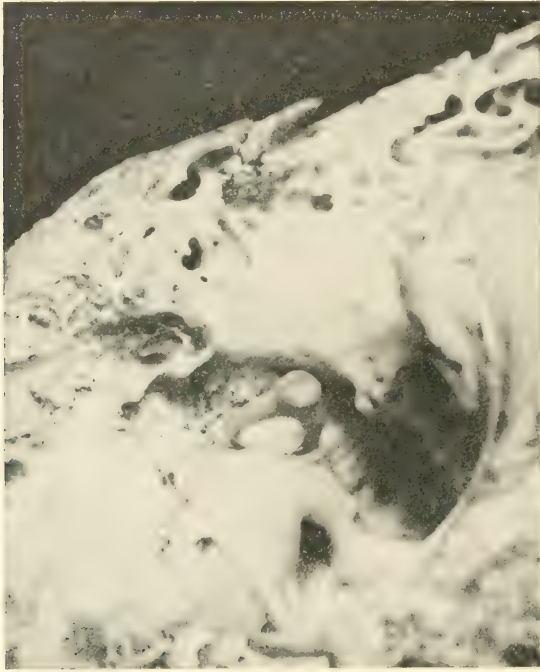


Fig. 1.

that the change in the bony capsule of the labyrinth is the essential feature of otosclerosis, and that the pathological changes sometimes found in the middle ear, and in the sound-perceiving apparatus, are either merely coincident or secondary.

Now, without going more deeply into these questions at present, it may be said that the change in the bony capsule of the labyrinth is, at least, the outstanding feature of the disease. Indeed, without such a change, it would not be justifiable to speak of a case as being one of otosclerosis. And it is noteworthy that Manasse, who holds the view that the condition

is primarily a change in the sound-perceiving apparatus, would banish the name otosclerosis altogether.

Speaking in general terms, the typical cases which we call otosclerosis present clinically the following symptoms: Deafness of insidious onset, relatively prolonged bone-conduction, a loss of hearing for the lower notes, and a normal position of the tympanic membrane. Besides these symptoms, there is sometimes present a rosy tint in the region of the promontory, and



Fig. 2.

paracusis and tinnitus are often referred to by the sufferers. Now, the evidence is very preponderatingly in favor of the view that these symptoms are due to a change in the bony capsule of the labyrinth, which has its seat usually in the region in front of and above the oval window, and leads to the bony fixation of the stapes. Frequently, of course, foci of bony transformation are present in the other portions of the capsule of the labyrinth, but there is not, so far as I am aware, any clear evidence that changes in such regions ever produce the characteristic signs and symptoms which, clinically, we term oto-



sclerosis. I will, therefore, proceed to show some slides illustrating the condition. The specimens and slides were prepared from a case of otosclerosis in its earlier stage.

The first slide<sup>1</sup> is taken from a macerated specimen of the temporal bone. The stapes, being united with the walls of the oval window by bone, remained fixed in position when the soft parts were removed. The object is viewed from the tympanic aspect.

The next slide<sup>2</sup> shows the same specimen viewed from the vestibular aspect, and it will be seen that the foot-plate of the

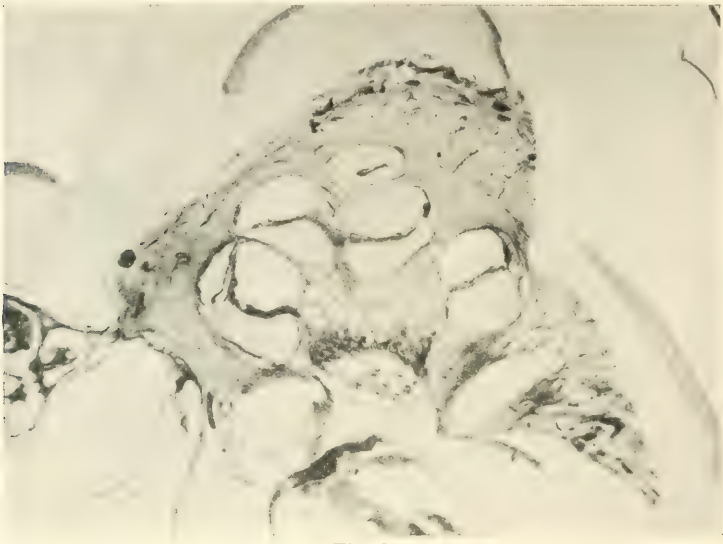


Fig. 3.

stapes is continuous with the inner surface of the bony labyrinth. In macerated specimens such as this, the new-formed bone is whiter than the normal tissue, and it will be observed that it extends above, in front of, and below the oval window. Both this and the preceding illustration may be seen to better advantage in my book on "Diseases of the Ear," where they are reproduced in stereoscopic relief.

Passing now to consider the bony changes in greater detail, it is necessary to employ microscopic sections for the purposes of illustration. Before doing so, however, I shall put on the screen a slide<sup>3</sup> illustrating the appearance as seen when the bone is not diseased. This slide was prepared from the temporal bone of a very old woman (aet. 101) who was absolutely

deaf to all sounds. It was a case in which the deafness was due to disease of the sound-perceiving apparatus and not to otosclerosis. The bone is quite healthy, and it is particularly to be noted that there is no spongification in the neighborhood of the oval window and stapes.

The next slide<sup>4</sup> shows in the same degree of magnification as the last, the conditions found in a very early case of otosclerosis which had been examined by me during life. The section passes through the *right* temporal bone at very nearly the same level as in the case of the last slide. The foot-plate of

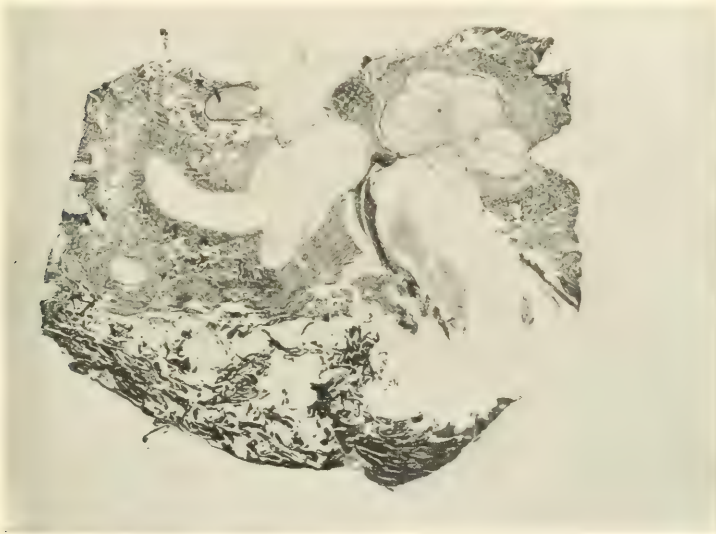


Fig. 4.

the stapes is visible, but the crura are below the level of the section.

In the wall of the labyrinth, immediately in front of the foot-plate of the stapes, may be seen a circular area of bone more darkly stained than the surrounding healthy bone tissue. This portion consists of the newly-formed bone, characteristic of the disease. Another focus of the same nature is seen to the right of the apex of the cochlea and reaching up to the membranous wall of the latter.

Even with this slight degree of magnification, it will be observed that the new-formed bone is much less dense than the healthy tissue, and hence the process has been termed spongification or osteoporosis. It is to be noted that the new-formed

bone is separated from the surrounding bone by a very sharp line of demarkation. Further, in this particular specimen, the new-formed bone has not invaded the stapedio-vestibular synostosis, and it may be added that in none of the series of sections from this case was the new bone found definitely to cross over into the foot-plate of the stapes. In other words, actual bony ankylosis has not yet occurred, it being a very early case.

The next slide<sup>5</sup> is prepared from the same section as the last and shows the region in front of the stapes more highly magnified. To the left is seen a small portion of the anterior end of the foot-plate of the stapes, while the newly-formed, spongy

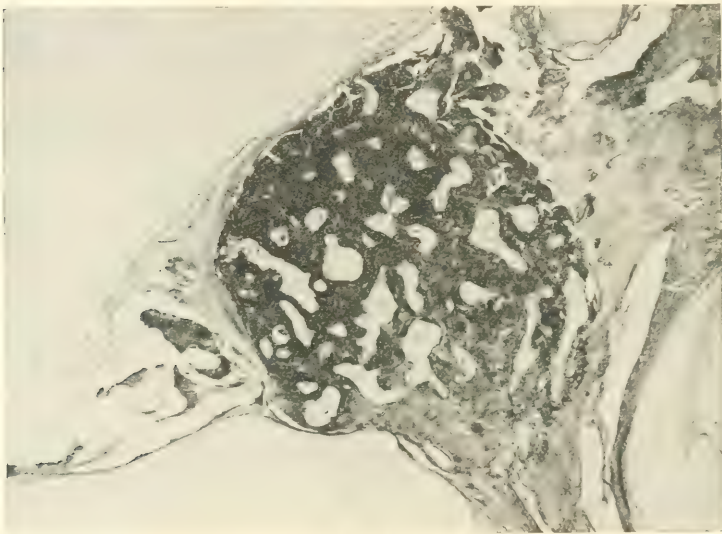


Fig. 5.

bone is seen in the middle of the field; and it may again be noted that the stapes is not involved in the bony change. The spaces seen in the spongy bone are occupied by bone-marrow, a condition not found in normal conditions in the capsule of the labyrinth.

The next slide shows the appearances present in the *left* temporal bone of the same case. The section passes horizontally below the region of the foot-plate of the stapes, but portions of both crura are seen. The spongy new-formed bone is very darkly stained in comparison with the feebly stained normal bony tissue. On this, the left side, the pathological bony change did not involve the stapedio-vestibular synostosis, as was also the case on the right side.



The next slide was not prepared by myself, but was very kindly given to me by Professor Brühl of Berlin. It illustrates very clearly a case in which the pathological change had proceeded farther than in my own just shown. In this slide it will be seen that in the spongification process, the stapedio-vestibular synostosis has been involved, and the stapes itself has been invaded.

In the next slide, which I prepared from one of my own sections, the stapedio-vestibular synostosis is seen much more highly magnified. The darkly stained new spongy bone comes

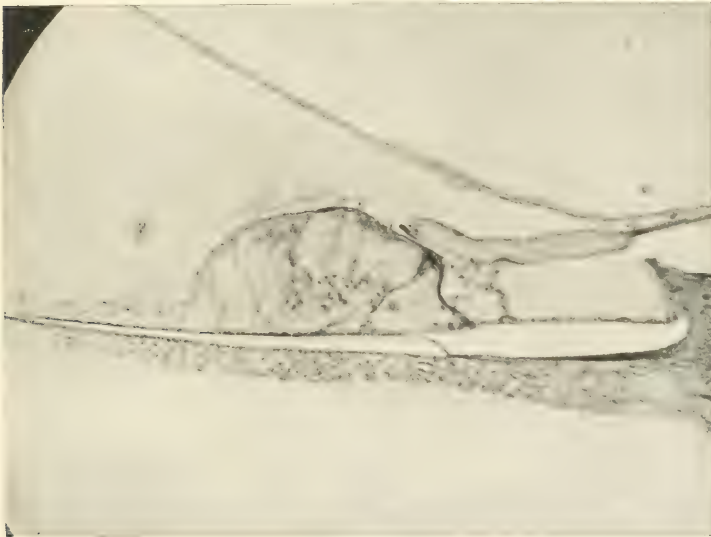


Fig. 6.

into very close relationship with the synostosis, but does not actually involve it, except, perhaps, at a minute area toward the upper part of the slide. At that point there is a cell on the stapelial side of the synostosis which certainly does look like an osteoblast in the process of depositing calcareous salts.

The next slide shows appearances similar to the last, and is also rather highly magnified. The more darkly stained area shows the minute structure of the newly formed spongy bone. The osteoblasts are seen lying in their bony matrix. The clear portion to the right shows the foot-plate of the stapes, and between the latter and the bone is the annular ligament. The section passes very obliquely through the upper portion of the synostosis.

The next slide<sup>e</sup> is shown for the purpose of illustrating the condition of the organ of Corti in the case from which the previous slides have been prepared. It shows nothing at all abnormal. Of course, the appearances are not those which are found in the organ of Corti of an animal in which the structures have been put in a fixing fluid at the moment of death. But in the human subject it is impossible to fix the tissues of the temporal bone until many hours after death, and during this interval maceration occurs. Hence, although the hairs themselves remain, the hair-cells, as is seen, have disappeared, but this is also found to be the case when one examines the structures under the same circumstances in subjects who have had perfectly normal hearing during life. There is no depression of the membrane of Reissner, and the rods of Corti and the tectorial membrane are normal in appearance. I may add that the ganglion spirale and the auditory nerve presented no abnormality.

#### A WORD OR TWO ABOUT NERVOUS RELATIONSHIP.

Having then, briefly described and illustrated the anatomical changes that occur in otosclerosis, we may proceed to consider the relationship which the hereditary tendency bears to their occurrence. In recent times the subject has been carefully investigated by Hammerschlag and Körner and others.

It is, of course, indisputable that hereditary tendency does bear a very definite relationship to the disease. Unfortunately, however, there is but little agreement as to the nature, meaning and extent of this relationship. Such divergence of opinion is, after all, not surprising when we reflect how much difficulty there is in ascertaining the relationship of hereditary influence to simple and normal anatomical conditions. When such is the case, then it would be surprising, if the relationship of hereditary tendencies toward pathological conditions were not even more mysterious and obscure. At present it is most desirable to gather facts from all possible sources which have a bearing on the question, before definitely formulating an opinion. This, therefore, is the excuse which I tender for drawing your attention to some details in the features of the family trees to be shown in the following slides. These family trees have not been selected for the purpose of illustrating very marked hereditary tendencies in respect to otosclerosis, but rather to point out certain features in the trees selected.

This slide<sup>7</sup> shows the tree over three generations on both the paternal and maternal sides, of a family of which I have personally examined all the deaf members in the present generation. The family consists of nine members, the oldest being forty-seven, and the youngest twenty-five years of age. Of the nine, six are deaf, and all these are victims of otosclerosis. On the paternal side, it will be seen that of a family of ten, only one was deaf, and the father himself did not suffer, though he reached an age far beyond that at which otosclerosis makes its appearance. The paternal grandfather, himself, however,

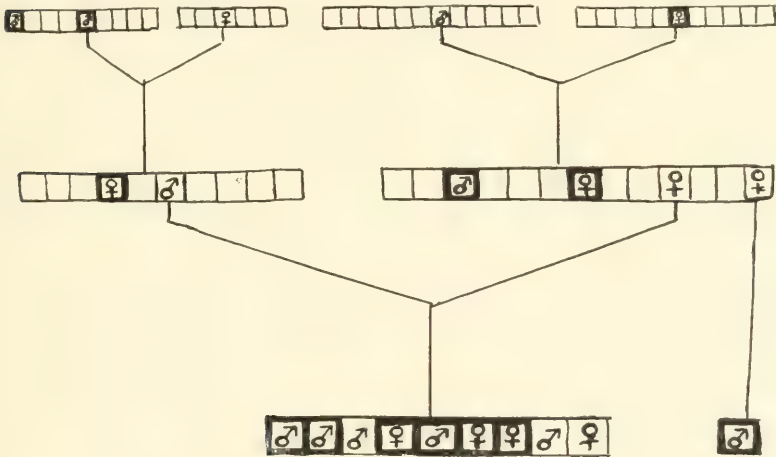


Fig. 7.

was dull of hearing, but all that is known of his deafness is that it appeared in middle life.

On the maternal side, out of a family of thirteen, two were dull of hearing in middle life, but the mother, herself, who is still alive, is not affected. The maternal grandmother was deaf. Finally, out of forty first and second cousins on the father's side, none are deaf, and out of thirty first and second cousins on the mother's side, only one is deaf, that one being shown on the slide.

How is this curious coincidence of otosclerosis to be accounted for? Mere coincidence, I venture to think, is out of the question, and the environment of the family has always been very satisfactory. The only explanation I have to offer is, that on both the paternal and maternal sides there is a slight tendency to otosclerosis, and, by the union of the two families, the weakness has been very markedly accentuated. It is important to add



that the two youngest members of the family are respectively thirty and thirty-five years old, so that it is quite probable that one of these may develop otosclerosis, and not improbable that both may do so.

The next slide<sup>s</sup> shows a family tree, on both paternal and maternal sides; and in this, as in the preceding case, there is clear evidence of deafness on both these sides.

The family of the present generation consists of six members, the oldest of whom is thirty-seven and the youngest, twenty-eight. Of the six members, three are deaf, and these have all

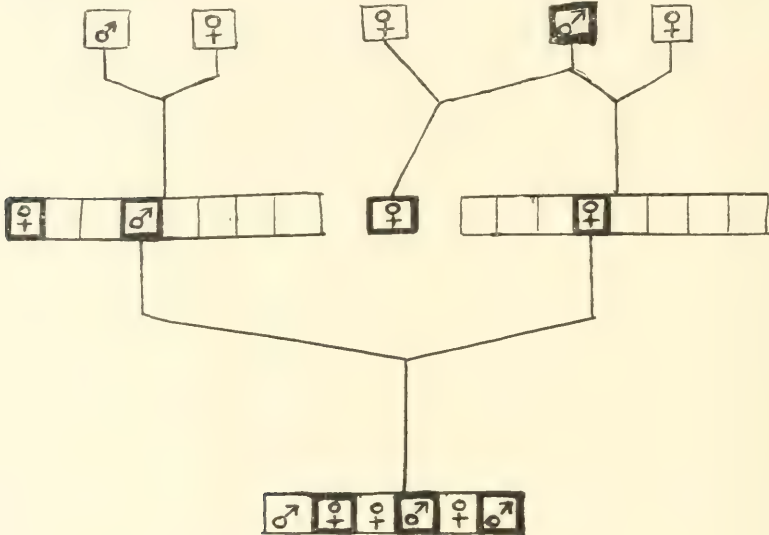


Fig. 8.

been examined by myself, and are all typical examples of otosclerosis.

The oldest member of the family is not deaf at all.

The second began to suffer from otosclerosis at the age of twenty-nine.

The third is not deaf at all.

The fourth began to suffer from otosclerosis at the age of twenty-nine.

The fifth is not deaf at all.

The sixth began to suffer from otosclerosis at the age of twenty-two.

Taking the paternal side of the previous generation, it will be seen that the family consists of eight members, of whom two are deaf, and the father of the present generation is one of these. He

has been examined by myself and is the subject of otosclerosis, but only in a mild degree. And it is further of interest to note that the deafness did not make its appearance until the age of about fifty-five. Neither of the paternal grandparents were deaf.

On the maternal side the family consisted of eight members and a step-sister. Of these eight sisters, only the mother herself suffers from otosclerosis. The deafness made its appearance about the age of thirty, but it has never been very severe in degree. The step-sister is also deaf, but I have not had the opportunity of examining her, and cannot definitely say whether the deafness is due to otosclerosis or not. The maternal grandfather was dull of hearing about the age of fifty and became progressively worse. Neither the maternal grandmother nor the step-grandmother were deaf, so that there is a very strong suspicion that the maternal grandfather transmitted a certain tendency to deafness to the two families by his two wives.

In this case, as in the first, therefore, we appear to have evidence of a family tendency to otosclerosis on both the paternal and maternal sides. In this family tree, however, both parents suffered in a mild degree from otosclerosis, whereas in the first tree both parents were free from disease. On neither side, however, is the tendency at all pronounced, but in the offspring of the marriage, otosclerosis manifests itself with great severity. This view is supported by the evidence derived from deafness among the cousins. There are in all forty first cousins, of the present generation, and of these only one is deaf. Of many second cousins, number not known, only two are deaf, but it is significant that these two are brothers. They are on the paternal side.

Before leaving this subject of the effects upon the offspring of the marriage of two individuals having a tendency to otosclerosis, I would like just to mention an even more marked case described by Hammerschlag. In his case an uncle married a niece, both of them sufferers from otosclerosis. There were seven children of the marriage, and every one of them became deaf.

These two first family trees throw light upon a very practical question which sometimes arises in respect to otosclerosis. It has been suggested by Körner, and the suggestion is supported by some other aurists, that the victims of otosclerosis should be discouraged from marrying.

Now, in so far as this advice is given with the object of preventing the birth of a certain number of individuals who would run the risk of developing otosclerosis when they reached adult life, it may be quite sound. Because there is no doubt that, taken over large numbers, the children of otosclerotics are rather more liable to suffer from the disease than those who are born of normal hearing individuals. But if it be regarded from the wider aspect of attempting to eliminate otosclerosis

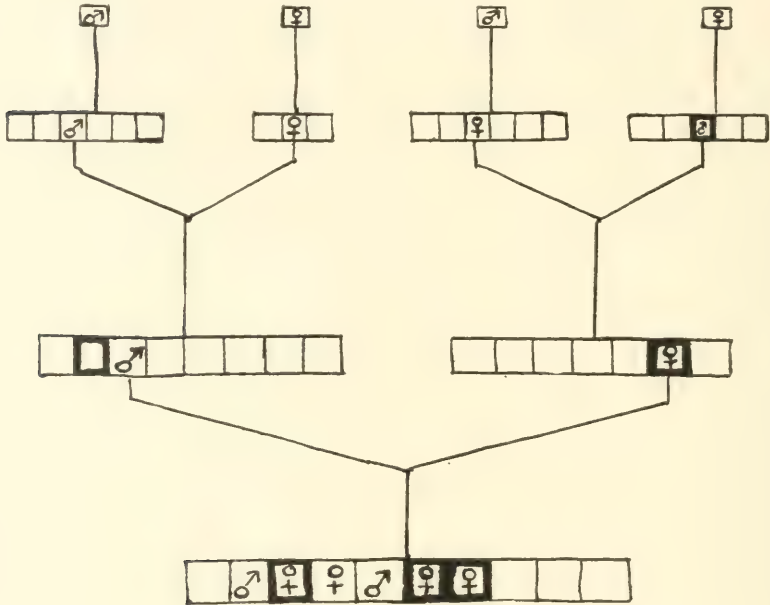


Fig. 9.

from the list of human troubles, it is open to serious question whether it is right to advise against marriage, and, the reason is obvious from an inspection of these two tables. Otosclerosis arises frequently in families in which the disease is either not present at all in the parents, as in the first family tree, or makes its appearance in the parents long after marriage has taken place. While, therefore, the forbidding of marriages of otosclerotics would to a certain extent diminish the number of sufferers, it is evident that this diminution would be very slight for, at any rate, many generations.

Now, when we consider that amongst practically all the white races the birth-rate is steadily diminishing, it must be obvious to any physician that, to give advice tending to em-

phasize this condition of affairs is to undertake a very serious responsibility. The sufferer from otosclerosis is not, like the deaf mute or the insane, a cost to the state, nor like the victim of pulmonary tuberculosis, a danger to his neighbors. He is, in general, a valuable citizen, though his defect may necessitate the direction of his activities into a channel different from that which they might otherwise have followed.

The next slide<sup>9</sup> is shown in order to illustrate the effect of local inflammatory mischief in the ear upon an individual in whom there was already a family tendency, though not very marked toward otosclerosis.

In the present generation, the family comprised originally ten members, but of these two died in childhood. Of the remaining eight, three are deaf, and all have been examined by myself, and of these the two oldest are undoubtedly subjects of otosclerosis. The youngest of the three deaf patients is the one to which particular attention is to be drawn. This patient, aged twenty-one, is extremely deaf. She cannot hear the watch or the whispered voice at all, and the shouted voice can only be heard when it is very loud, and within two or three inches of the ear. Rinne's test gave -5secs. in the right, and -7secs. in the left ear; Schwabach's test gave -3 or -4 secs. in the right, and -5 in the left ear. Thus, although Rinne's test was negative in both ears, yet the bone-conduction was diminished. The high notes on Galton's whistle were remarkably well heard considering the severe deafness, but the hearing for the low notes was very seriously affected in both ears. The tympanic membrane on the right side was almost completely destroyed by a long antécédent suppurative process, and this allowed of a remarkably extensive view of the contents of the tympanic cavity. All the ossicles were present, and the tip of the hammer was adherent to the wall of the promontory. The anterior portion of the stapes and the long process of the anvil were visible and there were no adhesions found in these parts. The round window was, so far as was visible, quite free of obstruction, and the mucous membrane was thin, dry, and glazed. Indeed, the appearances were all those which one would expect to find associated with comparatively good hearing. In the left ear, the membrane was almost entirely destroyed, and there was a slight purulent discharge associated with some degree of swelling of the mucous lining of the tympanum, and this prevented the clear view of the parts



that was possible on the right side. The history of the case showed that the patient heard well until the age of nine, when she suffered from a double suppurative otitis media. After about a year, the suppuration was healed on the right side, but on the left side it continued until the present time. Since its onset the deafness has become slowly and steadily worse in both ears. There was never any giddiness or symptom of disease of the vestibule or semi-circular canals. We have here, then, a case in which the degree of deafness and the clinical symptoms cannot be entirely accounted for by middle ear disease, nor by disease of the sound-perceiving apparatus. In view of the fact that the two older members of the family are undoubtedly otosclerotics, I venture to think that the most

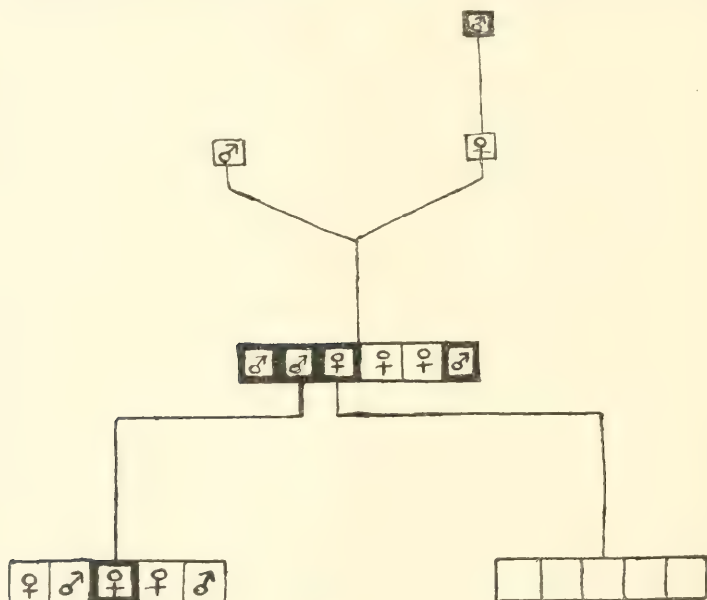


Fig. 10.

reasonable explanation is, that the suppurative process was the exciting cause of otosclerosis in an individual in whom the tendency to the disease was present in greater or less degree. This view is supported by the fact that the mother of the present family suffered from deafness, paracusis and tinnitus, an association of symptoms ominously suggestive of otosclerosis. The maternal grandfather also was deaf. One aunt on the father's side was dull of hearing, but the nature of the deafness cannot be ascertained.

The next slide<sup>10</sup> shows the family tree of an individual in whom otosclerosis made its appearance at a much earlier age than is usual. The present generation consists of five members, of whom the oldest is eighteen, and the youngest is five and a half years old.

Of these only one is as yet deaf. She began to suffer from tinnitus and deafness at the age of thirteen, and is a typical case of otosclerosis. I have little doubt but that in the course of time other members of the family will also fall victims to the disease. The father's family consists of six members, of whom four are deaf. Of these four, the father himself is one, and I have found on examination that he suffers from typical otosclerosis. The disease began about the age of thirty-one. Of three other deaf members of the father's family, two

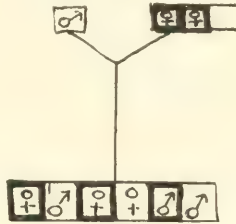


Fig. 11.

suffer from paracusis and tinnitus in addition to deafness, and the third suffered from tinnitus, but whether paracusis was present in his case cannot now be ascertained. In none of them is there any history of suppuration. The paternal great-grandmother was deaf, but the nature of the deafness cannot be ascertained. On the maternal side there is no history of deafness in any of the relatives.

The next family tree<sup>11</sup> is very incomplete because my patient went abroad almost immediately after seeing me, and had not time to look up the details of the question. In this case, however, the matter is of less importance than in most, because the members of the family themselves recognize that on the mother's side deafness has been a very marked feature of their ancestry for at least four generations.

The present family consists of six members, the oldest being forty-one and the youngest twenty-one years of age. Of the six, three suffer from otosclerosis. The most interesting of the three cases is that of the oldest, and I will mention a few details concerning her case because it illustrates an important point in regard to the etiology of the disease.

There was no affection of the hearing in either ear until the patient was twenty-five years of age. At that time she was out fox hunting one day, and, during a long run, was exposed to a bitterly cold east wind on her left side. An hour or so after returning home, she began to suffer from acute middle ear inflammation, which lasted three or four days; but suppuration did not ensue. Her medical attendant at the time gave her a good prognosis in regard to her hearing; and in this he was quite justified, for, as we all know, in acute middle ear inflammation without suppuration the hearing almost invariably returns to the normal in the course of a few weeks at most. Unfortunately, in this case, however, the prognosis proved incorrect, and the deafness in the left ear, so far from diminishing, has gradually increased ever since. This left ear is the seat of a typical condition of otosclerosis, the characteristic rosy tint over the region of the promontory being present, as well as the other symptoms of the disease.

The hearing of the right ear remained perfectly good until three years ago, when she noticed that it also was gradually becoming dull, and this was associated with a mild degree of tinnitus in the left ear. A few months previously the patient had suffered from an attack of appendicitis, but it did not occur to her or her medical attendant that there might be any connection between the abdominal trouble and the dullness of hearing. A second attack of appendicitis occurred, and then a third, which last was so severe as to necessitate an operation for the removal of the appendix. Within a few months after the operation the tinnitus disappeared, and the deafness is not as yet noticeably worse.

On present examination it is found that the right ear also is the seat of typical otosclerosis, the rosy tint over the region of the promontory being present as in the left ear.

Thus, there is in this case, an interval of more than twelve years between the onset of otosclerosis in each ear respectively. I think there can be no doubt that the acute middle ear inflammation must be held responsible for initiating the otosclerosis in the left ear. In regard to the right ear, the association between the appendicitis and the otosclerosis is certainly not quite so clear, but the coincidence is very suspicious, especially when we bear in mind the fact that the tinnitus disappeared after the removal of the appendix.

The next slide<sup>12</sup> is shown to illustrate the difficulty in some cases of estimating the extent to which the hereditary element is present in a given family. The present generation consists

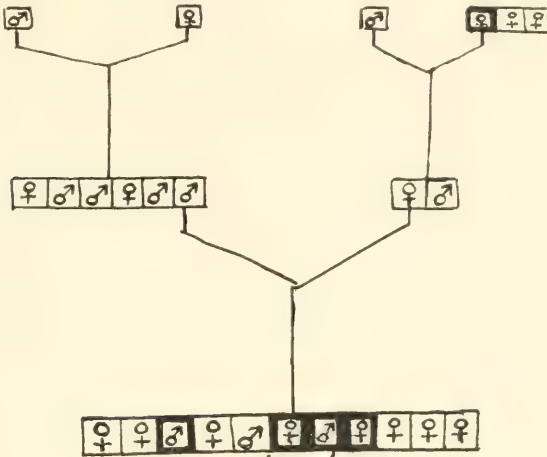


Fig. 12.

(The subjects bracketed were twins.)

of eleven members, and of these, four are the subjects of otosclerosis. Two of those affected are, moreover, twins, but they are not "identical" twins. No exciting cause could be found to account for the condition in any of the four. In spite of this, inspection of the family tree shows very little evidence of oto-

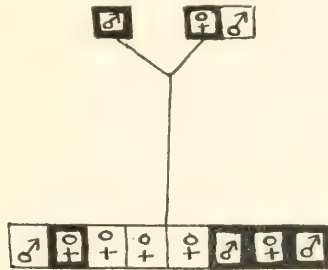


Fig. 13.

sclerosis. The maternal grandmother was deaf, but no proof is now obtainable that her deafness was due to otosclerosis.

From this family tree, therefore, we cannot draw any very satisfactory conclusion with regard to heredity. The tree must be allowed at present to stand as a record of fact.

The next genealogical tree<sup>13</sup> can only be analyzed over the



present and immediately preceding generations. The patient was unable to give any information concerning her grandparents. It is shown for three purposes. The first is to point out the difficulty of getting some individuals to admit that there is any tendency to deafness in the family, even in the face of the most unquestionable facts recognized by the sufferers themselves. The second point is, to show another case in which the tendency was very probably inherited from both parental and maternal sides, and the third is, to show how different factors may act in calling otosclerosis into existence when there is an inherited tendency to the disease.

The present generation consisted of eight members, but of these one died in early childhood, before reaching the age at which otosclerosis is liable to manifest itself. Of the remaining seven, four are deaf. The oldest of the four patients attributes her deafness to scarlet fever, and in a sense this may be correct. But there is no history of pain in the ear during the scarlet fever, nor any suppuration; the deafness, is moreover, bilateral. She suffers from severe tinnitus in addition to the deafness, and paracusis is marked. There are, therefore, two possibilities as to causation in this case. First, it may be a case of adhesive processes occurring after scarlet fever; and second, it may be a case of otosclerosis in which the scarlet fever was merely the exciting cause in an individual in whom there was a marked family tendency to the disease.

The next deaf member of the family is at present forty-six years old. Tinnitus and paracusis are both present, and there is no history of suppurative disease or pain in the ear. The deafness is bilateral. Now, in this case the deafness is attributed to a fall from a horse. But on inquiry it appears that the accident was not very serious, for the patient was up and out of doors two days after it. There was no giddiness nor any symptom pointing to direct injury to the labyrinth. Furthermore, the deafness did not make its appearance until a few weeks or a month after the accident. In view of the history and symptoms of the case, associated with what is known of the family history, there is, I think, little doubt that this also is a case of otosclerosis occurring in a family in which there is a marked tendency to the disease, though possibly the accident may have been the exciting cause.

The third deaf member of the family was examined by myself, and the case was one of typical otosclerosis. In this case

the patient attributed the deafness to a rather prolonged period of sea-sickness. While the sea-sickness may have been the exciting cause, I am not willing to admit that it alone could produce otosclerosis unless there was an inherited tendency to the disease.

In the fourth deaf member of the family the deafness, which is bilateral, is associated with paracusis. I have not had an opportunity of examining him. The deafness was attributed to colds in the head and nasal polypus, and this, probably, with justice. But again, I venture to think that the nasal conditions were the immediate cause only.

In the previous generation the father's family consisted of

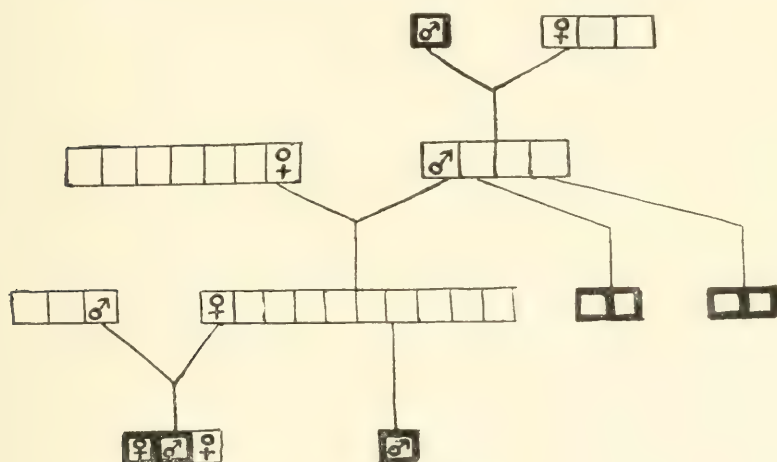


Fig. 14.

one member only, the father himself. He suffered from bilateral deafness, considerable in degree, and associated with paracusis. It cannot be ascertained whether tinnitus was present or not.

Nothing is known of the paternal grandparents.

On the maternal side, the family consisted of two members, the mother herself and a brother. The mother suffered from bilateral deafness associated with paracusis, but it is not known whether tinnitus was present or not. The brother in this generation was not deaf.

Of the maternal grandparents nothing is known at all.

When the family tree is considered in relation to the individual cases, it appears to illustrate the condition in which an inherited tendency to otosclerosis may be made manifest through the intervention of different local and constitutional conditions.

The last slide<sup>14</sup> shows a family tree in which deaf-mutism was associated with otosclerosis, but the question as to whether there is any relationship beyond mere coincidence must remain in some doubt.

Four members of the present generation are shown on the screen, one family of three and another family of one.

Of the first family the oldest is nine years of age. She is said by her mother to have been always a little dull of hearing and was a little late in learning to speak, but at the age of four she was able to speak fairly well, and is now quite a good speaker, having a vocabulary not noticeably inferior to that of normal hearing children. For the last six months the mother has noticed that the child has become much duller of hearing. Bone-conduction is prolonged, the membrane is normal in position on both sides and shows a rosy tint over the region of the promontory: the low notes are lost to a relatively considerable extent. The second child of this family is six years old. I have not had the opportunity of examining her, but she is a deaf mute, and, according to her mother always has been completely deaf. The third child, aged five, has at present quite normal hearing and speaks well. The cousin is a deaf mute.

In the previous generation there is on the father's side no known history of deafness or deaf-mutism. On the maternal side it is curious to note that in the mother's own family, out of a large membership of ten, none are either deaf or deaf mute, but a niece (already referred to) is a deaf mute. Furthermore, the mother has four cousins who are deaf mutes.

Among both the maternal grandmother's family and the maternal grandfather's family, there is no deafness or deaf-mutism. The maternal great-grandfather, however, became deaf shortly after the age of five and lost what speech he had already learned.

This tree is interesting, therefore, as showing that hereditary deaf-mutism is not always congenital, and may even make its appearance as late as the fifth year of life. It also shows how the defect may lie latent over one or even two generations. And finally, it suggests the possibility that otosclerosis occurring at a very early age may be associated with deaf-mutism in the same family. More facts will have to be gathered before we can say whether, in respect to the last mentioned association, there is any casual relationship.

Now before bringing my address to a close, I would like to

make a very few remarks upon the conclusions which we draw from a consideration of these family trees. And I must admit that such conclusions are destructive rather than constructive in their nature:

1. In the first place, it is clear that the relationship of hereditary influence to otosclerosis is much more complex than has been supposed, but at the same time such relationship is very close.

2. It is quite futile to attempt to divide cases into those due to hereditary influence and those not due to this cause. And, consequently, it is not only useless, but actually misleading to refer to a certain percentage of the cases as being inherited. Each aurist will hold a different opinion as to what constitutes evidence of inheritance, and such estimates, therefore, become merely statements of opinion.

3. In all cases, however clear the evidence of hereditary tendency may be, local and constitutional conditions may play an important part in determining the onset and course of the disease.

4. The attempt to attribute all cases of otosclerosis to inheritance from some more or less remote ancestor, who may have suffered from the disease is, at present at least, unjustified. A great deal more must be learned in respect to the general laws of inheritance before conclusions can be drawn concerning the relationship which exists between inherited tendencies and pathological conditions such as otosclerosis.

At present it is our duty to collect as much evidence as possible concerning this subject. When this has been done we will not only be in a much better position to give an opinion in regard to treatment and prevention, but will also be able to offer a large amount of material for the study of heredity in general, a study which, I am convinced, is destined to play an increasingly important part in medical science.

The study of the causation of disease in many of its most important aspects have been obscured and narrowed during the last twenty years by the ascendancy which bacteriology has obtained in pathology and medical science generally. There is evidence that a wider outlook upon processes of disease will be taken in the near future; and then, it may be hoped, the physician will again reign in his own household.



## AFTER TREATMENT OF THE RADICAL MASTOID OPERATION, WITH SPECIAL REFERENCE TO THE SUBJECT OF PACKING.

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NEW YORK, N. Y.

In another communication, I have given my views regarding the purpose of the radical mastoid operation in the following language:

"The purpose of the radical mastoid operation is to convert the external auditory canal, tympanic cavity, aditus ad antrum, mastoid antrum and mastoid cells, when diseased, into one wide-open cavity; to excavate all granulations and diseased bone, to destroy all membranous and muscular tissue lying within these limits, including the membrana tympani, and to effect dermatization throughout the entire area, in the hope that by so doing the ramifications of the disease will be terminated once and for all."\*

Any discussion of the after treatment of this operation, which requires so extensive a dissection of the most complicated bone in the human body, must necessarily be based upon the assumption that the operation itself has been completed in every particular, even to the construction of a suitable meatal flap and the proper closure of the post-auricular wound.

The proper after treatment of the radical mastoid wound is most essential to the final success of the operation, in fact, the surgeon must possess the same measure of knowledge and skill regarding the technic of the post-operative treatment of the resultant wound as for the operation itself, inasmuch as many failures to secure good results are directly due to careless or unskillful post-operative treatment. Hence, no otologist should undertake the responsibility of the operative management of a case needing the radical mastoid operation except he be equipped to bestow the required time and skill until the final healing has been secured. The period over which the after treatment extends usually varies from one to three months.

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\* Diseases Ear, Nose and Throat, Phillips; page 279.

Whatever opinion may be held regarding the length of time during which the denuded areas in the bone and the external auditory canal shall be packed with gauze, otologists generally agree that at the primary dressing the entire wound cavity should be closely packed with strip gauze introduced through the external auditory canal.

Under usual circumstances the primary gauze packing should remain untouched until the fifth or sixth day, when it should be removed and renewed. The external dressing, however, may be renewed daily, a procedure which permits of the inspection of the post-auricular wound and the removal of stitches which may no longer be needed. Furthermore, the daily inspection of the post-auricular wound enables the observer to discover any stitch infections and to keep the united surfaces clean and dry. Whenever firm union has taken place the stitches should be promptly removed and all stitches which show any sign of local infection should be removed at once.

Whenever the post-auricular wound is healed the further use of heavy gauze pads and bandages should be dispensed with. As a rule the outer dressings are discarded after about the tenth day. Great care should be exercised during the removal of the primary packing from the osseous wound cavity in order not to disturb or displace the meatal skin flaps or the skin grafts, provided they have been inserted at the primary operation. Furthermore, gentleness during this procedure prevents unnecessary pain, thus tending to safeguard the confidence of the patient. The cut surfaces in the fleshy portions of the wound are exceedingly sensitive and the slightest touch to these areas results in severe pain.

While the removal of the primary packing is a painful procedure, the reinsertion of the second dressing is still more painful. For this reason the dressings may be saturated with sterile vaseline.

Opinions vary regarding the degree of pressure with which the gauze should be packed in the cavity after the first few dressings. Two general views regarding this matter obtain at the present time. (a) Those who prefer very tight packing, and (b) those who do not tampon the cavity at all after the primary dressing is removed, each claiming good results.

Between these extreme views all grades of pressure of the gauze packing have their advocates.

During the earlier periods in the history of the radical mastoid operation, the opinion generally prevailed that tight packing was essential throughout for the control of the granulations and to hasten epidermization.

In the writer's experience more favorable results have been obtained when the middle ear spaces have been snugly packed at each dressing for the reason that he has thereby been enabled to prevent the osseous wound cavity from becoming completely blocked with exuberant granulations during the healing process.

Whatever the after treatment may be, the object to be obtained is a smooth, firm granulating surface which rapidly invites the spread of epidermis from the skin margins of the wound. At the termination of about two weeks, the posterior or mastoid portion of the osseous wound cavity should be very lightly packed in order that the deeper areas of the wound may fill in with granulations, for it is obvious that a small resultant cavity in the remote areas is less liable to become fouled with exfoliated epithelium than those of larger calibre.

Considerable experience in testing all methods of after treatment has convinced the writer that to lessen the calibre of the posterior areas of the wound by permitting the granulations to fill in as rapidly as is consistent with the healthy state of the same, is not only without detriment to the final result, but is positively advantageous. A daily change of the gauze packing is advisable, but in many instances, especially in patients who are dependent upon clinic treatment, it is difficult to arrange for the removal of the dressings oftener than once in two days. At each dressing the osseous wound cavity should be thoroughly inspected and all exuberant and flabby granulations destroyed or removed in order that they may not become a barrier to the invasion of the epidermis from the flap margins. Excessive secretion should be wiped away, inasmuch as by bathing the granulating surfaces the moisture renders them soft and flabby and at the same time tends to macerate the epithelial surfaces. The latter fact is an argument in favor of the daily change in dressings. In other words, the wound surfaces should be kept as dry as possible. In some instances it may become necessary to apply caustics to unhealthy or exuberant granulations. Strong silver

nitrate or orthochlorophenol applications are favored for this purpose.

It is rarely necessary to stimulate granulations, but if so, Balsam of Peru may be applied to the sluggish areas, or the desired results may be obtained by the temporary substitution of iodoform gauze for the plain gauze. With the diminution of the secretion the surface of the cavity should be covered with boric acid powder or aristol, or a mixture of these, before replacing the tampon.

While the length of time during which it is advisable to continue the packing treatment of the radical mastoid wound cavity is a matter of individual opinion, and any statement pertaining thereto may become a subject of criticism, it is the opinion of the writer that said packing should be discontinued as soon as the granulations have become hard and firm and the wound surfaces have become smooth and comparatively free from secretion. As a rule this occurs during the third or fourth week. The real purpose of the gauze packing is to protect the freshly denuded surfaces from infection and to aid in controlling excessive and unhealthy granulations. As soon as this mission has been accomplished it is well to discontinue with it and to obtain the benefits to be derived from the contact of the air upon the newly acquired skin surfaces. After dispensing with the packing the further treatment consists in keeping the areas dry by the removal of any retained secretions until dermitization is complete. This period may be prolonged for several weeks, but in favorable cases healing takes place in from five to ten weeks.

A discussion of the post-operative treatment of the radical mastoid wound may not be considered complete without mentioning post-auricular fistulas, facial paralysis and persistent discharge, either from the tympanic orifice of the Eustachian tube or other areas of the osseous cavity.

*Post-auricular fistulas* are exceedingly rare in cases wherein the primary closure of the wound has been properly performed and in a manner which does not produce strain upon the stitches. The mattress suture or the Michel metal clamp sutures are often of great benefit in relieving the strain upon the approximated edges. Should a post-auricular fistula result, it then becomes necessary to resort to one of the plastic operative procedures which have been devised for this purpose.

*Facial paralysis* without complete destruction of the nerve



trunk requires but little treatment, in fact it seems to recover fully as quickly without treatment as with it. Such remedial measures, however, as tend to stimulate the digestive function and correct faulty nutrition may be employed. For this purpose a moderate use of salines and internal administration of iron, strychnia or iodine compounds are recommended. The Faradic current arm massage of the paralyzed muscles have long been advocated as a means for restoring the nerve function. These measures may be of slight value even in cases wherein the nerve trunk has been severed and may prove of some benefit in preventing muscular atrophy in the more severe cases of complete paralysis. The surgical treatment, the purpose of which is to restore the function of the nerve by grafting its distal end into the trunk of either the hypoglossal or spinal accessory nerve has proven successful in a limited proportion of cases. The knowledge that the restoration of function in many cases of severe injury to the facial nerve occurs spontaneously after prolonged periods of time, renders it difficult to decide whether the anastomosis operation should be attempted. In the writer's judgment the operation should never be attempted except when the nerve has been completely severed and the best interest of the patient is often better conserved by delaying the operation than by taking a chance of possible failure in the anastomosis procedure, said failure always resulting in permanent loss of function in the facial nerve.

*Persistent Discharge.* The treatment of persistent discharge from the cavity of the wound must be conducted in accordance with the nature and source of such discharge. Whenever the discharge is due to necrosed areas within the tympanic orifice of the Eustachian tube it becomes necessary to curette these areas in a most thorough manner. A similar procedure is necessary when other areas of the osseous wound cavity are the seat of bone necrosis. While it must be admitted that in certain cases under the most favorable circumstances some discharge may persist indefinitely, in the majority of instances this result is due to unskillful and inefficient operating. The more thorough and radical the removal of the necrosed areas, providing the post-operative treatment is carried out as above described, the less likelihood is there of persistent post-operative otorrhea.

It should be clearly understood that the post-operative treat-

ment herein described refers only to the classical radical mastoid operation. With the post-operative treatment of the so-called modifications of the radical mastoid operation advised by Heath and a few followers in America, the writer has had but little experience. The fact that these modifications are necessarily incomplete, inasmuch as the annular ring, the outer wall of the additus and the ossicles, three of the chief centers of necrosis in this disease, are untouched is sufficient condemnation of these procedures.

#### DISCUSSION.

DR. S. KOPETSKY, New York:—I rise, only to substantiate Dr. Phillips' contentions, because I am fortunately situated in being associated with him and thus see some of his results. I regret that I again have to disagree with my good friend Dr. Ballenger in reference to the Heath operation. I would like the detailed histories and also the pathologic findings in the cases wherein the Heath operation was performed, and I would like to ask why a simple mastoid operation would not have accomplished as much. Heath's work is *not* founded on logical pathology, and I am sure that were Dr. Ballenger to analyze his fifty cases he would find that they would have yielded to a simple mastoid operation.

DR. W. L. BALLENGER, Chicago:—The topic of the paper is the after-dressing, of mastoid cases. I belong to the school of surgeons who do not believe in packing the mastoid wound at the time of operation or at any time afterwards. I claim no originality in this respect. It has been established by the best practical general surgeons in the world; I would apply the same principles to the mastoid wound as all surgeons do to other suppurative conditions of the body. The purpose of dressing is not what Dr. Phillips thinks of it. It is not the purpose of the dressing to protect the granulations, it is not to prevent them from becoming exuberant, because the fact that you put in a tight or snug dressing will favor the formation of exuberant granulations, which shows that it jeopardizes the very thing that he is attempting to protect. The way to protect a wound from forming exuberant granulations is to permit drainage of that wound. You cannot promote it if you put in a tight dressing. The dressing first becomes saturated with the secretions; next, of necessity, the pus is held in contact with the entire lining of the wound, which does not protect but jeopardizes it. If you want to protect, put in a wick that is barely large enough to carry off the secretions as fast as they are formed. For five years—I believe Dr. Beck started it at the time—suggested it—I have been using a one-half inch of wick gauze, perhaps three inches long. I insert that into the meatus in radical and acute cases; just carrying it to the most dependent portion of the wound; in the position the patient will assume in the next twenty-four hours—I don't fold it in the wound at all. Then put a large pad over the wound, and this large external pad is protective. The internal dressing is for drainage purposes only. I wish to state that I get very good results—better than with the method pursued by Dr. Phillips. Of course, we all get failures in our work, but I get splendid results by this method.

DR. C. M. ROBERTSON, Chicago:—Dr. Phillips has said that he packs the wound tightly.

Dr. Ballenger does not pack at all, simply placing a slight drain in the bottom of the newly made cavity.

I try to pack and drain at the same time.

If we place our dressing too tight we dam back the secretions and interfere with granulation.

If we place our gauze too loosely we favor decomposition of secretions and allow the granulations to become exuberant.

I have noticed that too long use of dressings keep the wound from healing and may produce a discharge by their irritation.

After discontinuing the use of gauze in these cases the epidermatization progresses very rapidly.

Exuberant granulations are not experienced as much in my cases since using the above method, and when they do appear I change my dressings, using a gauze of yellow oxide of mercury in vaseline for a day or two, instead of cauterizing with silver salts or copper.

DR. JOS. BECK, Chicago:—I believe the writer of the paper and the gentlemen who discussed it are both wrong in the difficulties we have with the after-treatment, because these are men who have had great experience. Their results are good with packing, and then there are others whose experience is good without packing. My conclusions are based upon the pathology and histology, as the trouble is in the pathological condition of the bone. Chronic suppuration of the ear is not simply one pathologic condition alone. We have, first, chronic suppuration with the purulent fistula, second, the chronic suppuration with cholesteatoma of the mastoid; third and fourth, chronic suppuration of the mastoid, leucic and the tubercular—they are four different classes, and they all act differently, in the after treatment. I am convinced now—at least, I will go on believing this, until something better is shown—that upon the examination of a chip of bone removed at the time of operation and examined histologically depends whether the cavity will heal rapidly or slowly, and thus far I have not failed very often to verify these statements. The general condition of the patient has to be considered also. Nothing was said by the writer about the eustachian tube. All parts anterior to the eustachian tube play an important role in the getting well of the patient. In regard to facial paralysis, wait as long as you have a reaction of degeneration of muscles of the face; if you wait beyond that time, hitching on the facial to another nerve by means of the galvanic current will do no good. As long as we get the worm-like reaction of the muscle, that is the time to operate. I would like to hear from Dr. Cott in regard to this. I belong to that accused number of men who have followed the Heath operation, and my results are not all good. I have not had fifty, but I have had about twenty-three cases. In those of children, say early adult life, with both ears suppurating and good hearing present, at least one ear should be operated by the Heath method.

DR. WEBSTER, Boston:—I present another method of treating these cases. This method is the same as Dr. Phillips' to the point of putting in the first packing, and leaving it in six or seven days. At that time remove the packing under ether and put in a skin graft sufficient to cover the entire denuded surface and leave it in three or four days. Then remove the packing and put in no further packing. Then you will have few further granulations to do with in favorable cases. One thing should be understood in this connection, however; it should be undertaken only in cases where you undertake to cure the middle ear suppuration that is largely limited to the middle ear. If you have a profuse suppuration outside of the middle ear, where there is a severe mastoid suppuration with post-aural abscess, then you cannot have the first wound sufficiently clean to put in your skin graft and have it take.

## TOPOGRAPHY OF THE LABYRINTH.

M. A. GOLDSTEIN, M.D.

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This is a field of anatomical details which I approach with much hesitation and diffidence. It is about time that the American otological world took a more active and definite interest in the pathology and microscopic anatomy of that most complicated structure—the labyrinth. The unusual activity which has been demonstrated in the development of this field especially by the disciples of the Vienna school, makes it absolutely necessary for us to familiarize ourselves with the minute anatomy of the labyrinth if we wish to intelligently follow the work that has been done along these lines. The general pathologist is not inclined to go into the details of this field, which are necessary for the intelligent coöperation with us in following cases of this character in the post-mortem room, and it rests with us to develop this subject intelligently. There is no field of our special work so difficult to master, as even those of us who have had a modest experience in the microscopic histology and pathology of the labyrinth can testify.

If part of this demonstration is familiar ground to many of you I apologize for presenting it, and plead that it is necessary to include it in order to obtain a comprehensive knowledge of our subject. To know the pathology of the labyrinth it is essential to know the normal microscopic anatomy and topographical relations of the more vital structures contained in this small but complex area of the petrous part of the temporal bone.

Another factor which makes it difficult for us in America to progress rapidly in this new field is the restriction on post-mortem examinations and the difficulty of obtaining a post-mortem on a middle-ear or labyrinthine case sufficiently early to ensure the preservation of the soft tissues of the labyrinth. In all of the recent investigations of the pathology of the labyrinth the best work has been accomplished on cases in which post-mortem examination of the ear has been made within eight hours after death; in our section of the country



it has not yet been found feasible to obtain post-mortems so promptly except in rare instances. A subject which has been dead longer than ten to twelve hours is usually unfit for preservation of the anatomical details of the membranous labyrinth; the bony parts are preserved and may be readily studied, but the delicate structures are most frequently ruined. There are insurmountable difficulties, therefore, not only in the unusual amount of time required for this study which our busy, active American otologists cannot afford to give to the question, but also the question of obtaining prompt post-mortem examination and the proper care and treatment of the post-mortem specimens. Until these conditions are improved we must content ourselves with the development of our subject-matter as much as possible by careful reading and by following the work of men who have had better opportunities, resources, and more time for the leisure study of this important pathology.

Here followed lantern demonstration.

## I. INDICATIONS AND CONTRAINDICATIONS FOR THE LABYRINTHINE OPERATION.

## II. IF OPERATION IS INDICATED WHAT SHALL BE ITS NATURE AND EXTENT?

WILLIAM LINCOLN BALLENGER, M.D.

CHICAGO, ILL.

Much confusion and difference of opinion still exists as to the indications for labyrinth surgery, and as to the nature or extent of the surgery when indicated. While in Vienna recently I endeavored to gain a clear conception of these problems, at first hand, from the men who have given them the closest and most conscientious study. I hope within this article to reflect as concisely and clearly as possible the views held by the Neumann group of European otologists, and shall only incidently refer to the views held by Alexander and others upon these questions, as I believe they are in some respects wanting in anatomical and pathological logic, and in sound clinical deductions.

*The Purposes of the Labyrinth Operation.*—(a) The chief purpose of the labyrinth operation is to prevent the extension of the purulent infection from the labyrinth to the meninges and the brain, also to check and cure an incipient meningitis having its origin from the labyrinth.

(b) The second purpose is to cure an offensive purulent otorrhoea which is perpetuated by a labyrinth fistula, left after the destruction of the labyrinth by a diffused suppurative labyrinthitis.

(c) The third purpose is to relieve the patient of a distressing giddiness which occasionally persists after the cochlear nervous apparatus is destroyed by a suppurative process, while the vestibular nervous apparatus is but partially destroyed, and gives rise to distressing and disabling giddiness.

### I. THE INDICATIONS AND CONTRAINDICATIONS FOR THE LABYRINTHINE OPERATION.

As a basis for the discussion of the indications and contraindications for the surgery of the labyrinth Neumann's table will be utilized, as it gives a simple and complete grouping of

the varying symptom complex to be encountered in labyrinthine and cerebellar disease, in which the question of operation upon the labyrinth must be determined. Neumann gives eight possible combinations of symptoms in which operation may be considered, in two of which operation is imperative, in two it may or may not be imperative and four in which operation is contraindicated.

It is assumed that suppurative otitis media or cholesteatoma is present in each of the eight groups and that a mastoid operation is indicated.

Neumann's Table of Indications:

No.	COCHLEA	VESTIBULAR APPARATUS	FISTULA	SPONTANEOUS NYSTAGMUS	INDICATIONS
1	Functionating (Hearing present) (+)	Functionating (+)	Absent (-)	Present Absent (-)	None None
2	Functionating (+)	Functionating (+)	Present (+)	Present Absent	None None
3	Not Functionating (Deaf) (-)	Not Functionating (-)	Present (+)	Present Absent	Operate Operate
4	Not Functionating (-)	Not Functionating (-)	Absent (-)	Present Absent	Operate Operate
5	Functionating (+)	Not Functionating (-)	Present (+)	Present Absent	Do not operate Retro-labyrinth dis. Do not operate
6	Functionating (+)	Not Functionating (-)	Absent (-)	Present Absent	Do not operate Retro-labyrinth dis. Do not operate
7	Not Functionating (-)	Functionating (+)	Present (+)	Present Absent	If develops quick, operate If develops slow, do not op.
8	Not Functionating (-)	Functionating (+)	Absent (-)	Present Absent	Same as No. 7

In No. 1 the cochlear and vestibular apparatus are functionating, fistula is absent, as shown by the test before the mastoid operation and by visual examination during the mastoid operation, and spontaneous nystagmus is probably absent, though it should be remembered that it is present in about 25 per cent

of normal cases when looking toward the angle of the eyes (Ruttin). In symptom complex No. 1 do not operate.

In No. 2 the cochlear and vestibular apparatus are functioning, fistula is present as shown by the fistula test, and visual examination during mastoid operation, and spontaneous nystagmus may or may not be present. *Do not operate labyrinth as only a circumscribed area of the labyrinth is involved and the disease is not progressive.* Complete the mastoid operation and carefully avoid curetting and probing the fistula. If the fistula is curetted or probed the labyrinth disease may become diffuse and operation necessary.

In No. 3 both the cochlear and vestibular apparatus have been destroyed by the suppurative process, fistula is present and spontaneous nystagmus may or may not be present. The patient is totally deaf in the affected ear, and the vestibular apparatus does not respond to the turning, caloric and fistula tests (though fistula is present). Operation on labyrinth is clearly indicated as there is nothing to lose and much to gain by operation. The cochlea being already destroyed, and likewise the vestibular apparatus, there is nothing to lose in these directions. In these cases the labyrinthine canals often remain the seat of suppuration, which discharges through the fistula into the middle ear. In time the process may extend by necrosis into the cranium, or it may become acute and extend via the internal auditory meatus and cause meningitis or brain abscess. To operate insures the prevention of the extension of the process to the cranial contents; whereas, failure to operate is attended by great probability of extension to the cranial contents.

In No. 4 we have the same symptom complex, except fistula, and the indications are to operate the labyrinth.

In No. 5 the cochlea is functioning, while the vestibular apparatus is not functioning; i. e., it does respond to the caloric turning or fistula tests, though fistula is present. (Such a case has not been observed.) In all cases in which the vestibular apparatus is destroyed by suppurative disease the cochlea is also of necessity destroyed. Hence in those cases in which the vestibular apparatus does not respond to the classical tests and in which hearing is present, it should be inferred that the lesion is not in the labyrinth, but is retrolabyrinthine; i. e., intracranial. This deduction is the more obvious in view of the greater vulnerability of the cochlear than the vestibular nerve. The cochlear nervous apparatus may be destroyed and the vestibular apparatus



remain intact, or at least retain some portion of its function; whereas, it must be an exceedingly rare occurrence for the vestibular apparatus to be destroyed and the cochlear apparatus remain intact.

Do not operate, the disease is retrolabyrinthine, the labyrinth is intact.

In No. 6 the same logic and deductions should be applied. Do not operate. The disease is retrolabyrinthine in so far as the total non-irritability of vestibular apparatus is concerned.

In No. 7 the cochlea is destroyed and the vestibular apparatus is functioning, fistula is present, and spontaneous nystagmus may or may not be present. If the labyrinth disease is not rapidly extending, or is circumscribed, do not operate. If it is rapidly extending operate at once.

In No. 8 the symptom complex is the same as in No. 7, except fistula is absent. The indications are the same as in No. 7. In No. 7 and No. 8, even when the process is not rapidly extending, extreme giddiness may necessitate operation to render life tolerable and work possible.

#### GENERAL DEDUCTIONS FROM NEUMANN'S TABLE.

1. Operate the labyrinth if the hearing is totally destroyed and the vestibular apparatus cannot be stimulated by the turning, caloric or fistula test; i. e., operate when the entire labyrinth is destroyed by suppuration.

2. Operate the labyrinth when the hearing is totally destroyed and the vestibular apparatus is still stimulated by either the turning, caloric or fistula test, provided the labyrinthine disease is acute and rapidly extending and fistula symptoms are either present or absent.

3. Do not operate the labyrinth if both the cochlear and vestibular functions are present, either with or without fistula.

4. Do not operate the labyrinth when the cochlea is functioning (hearing present), and the vestibular apparatus is not functioning, as such cases are retrolabyrinthine and not labyrinthine disease, even though suppurative otitis media and fistula are present. When the vestibular apparatus is totally destroyed the cochlea is also always destroyed, as the cochlear nerve is more easily destroyed than the vestibular. Hence, if the cochlea is functioning, and the vestibular apparatus is not functioning, it is proof positive that the disease is not in the labyrinth, but is intracranial or retrolabyrinthine and involves the vestibular nerve.

*General Considerations.*—Careful scrutiny of Neumann's table reveals some interesting facts, which, if rightly understood, will greatly simplify the problems involved in arriving at the correct conclusion as to the indications for the treatment of labyrinthine disease.

*The first* significant fact is that the presence or absence of fistula exerts no influence on the decision. Note that in each symptom complex from No. 1 to No. 8 inclusive, fistula may or may not be present in each group, and the indications are in no wise affected by its presence or absence.

*The second* significant fact is that the presence or absence of spontaneous nystagmus exerts no influence upon the decision for or against operation.

*The third* significant fact is that only the first (cochlear) and second (vestibular) columns are of value in determining for or against labyrinth operations.

Of these columns, the first or cochlear, is of the greatest importance. It will be noted that a dead cochlea (total deafness) is the chief determining factor favoring operation. A labyrinth operation should rarely or never be performed while even a remnant of hearing remains.

The second or vestibular column is also of great importance in determining for or against labyrinth operation. If both the cochlear and vestibular functions are destroyed, that is, the deafness in the affected ear is absolute, and the vestibular apparatus does not respond to the turning, caloric or fistula test, the indications are positive for labyrinth operation.

If, on the contrary (symptom complex No. 7 and No. 8), the cochlea is totally destroyed (deafness is absolute) and the vestibular apparatus is still functioning (responds to the turning, caloric or fistula test), and the disease is rapidly extending through the vestibular portion of the labyrinth, or to the cranial cavity as shown by the reversal of the direction of the nystagmus, the indications for labyrinth operation are imperative and immediate. If, however, the disease is not rapidly extending, as shown by the symptoms, the indications for operation are negative. Such a case should have only the mastoid operation and should then be kept under close observation for a while in order to note the progression or non-progression of the labyrinthine disease. If, at a subsequent time the disease becomes rapidly progressive the labyrinth operation should be performed.

The *fourth* significant fact is that fistula *per se* is never an indication for the labyrinth operation.

The *fifth* significant fact is that spontaneous nystagmus *per se* is never an indication for the labyrinth operation.

## II. IF OPERATION IS INDICATED, WHAT SHALL BE ITS NATURE AND EXTENT.

We now approach the controversial aspect of the problem. Neumann and his school advocate the complete exposure of the vestibular and cochlear apparatuses in all cases; whereas, Alexander and his school advocate the total exposure of the labyrinth in selected cases, and partial exposure in others. The indications for operation are essentially the same by both schools of thought. Their practice is, however, quite different. Neumann and his school contend that if an operation, the extent of which falls short of complete exposure of the labyrinth, the internal auditory meatus, and the pyramidal mastoid cells, will often fail to protect the patient from the dangers of subsequent meningitis and cerebellar abscess. Alexander and his school contend that a partial exposure of the labyrinth (drainage only) is sufficient in most cases to cure the disease and protect the patient from subsequent meningitis and cerebellar abscess.

What are the anatomical, pathological and clinical facts by which we may be guided in arriving at a correct solution of this vexed problem?

The number of cases of labyrinth fistulae discharging foetid pus after spent purulent diffuse labyrinthitis is *prima facie* evidence that mere drainage established by natural means is not always sufficient to cure the suppurative and necrotic processes. Hence artificial "drainage" may also fail to check the purulent destructive process, and as often as it fails the dangers of meningitis and cerebellar abscess are still present. Whereas, if Neumann's labyrinth operation is performed these dangers are forever eliminated. According to Ruttin, in one hundred complete labyrinth operations only one death occurred as a result of the operation. These statistics indicate the comparative safety of the complete Neumann operation.

The pyramidal mastoid cells are present in a considerable percentage of skulls examined and may be the seat of suppuration, which, if not removed may eventuate in meningitis or cerebellar abscess. A partial labyrinth operation for "drainage" does not remove these cells. The complete Neumann operation includes

the removal of these cells and the operation thus forever frees the patient from the dangers of subsequent meningitis and cerebellar abscess, in so far as the labyrinth and mastoid disease is concerned.

To me it appears, therefore, that the Neumann operation should be the operation of choice, and that the partial operation for "drainage" is inadequate and must in the long run needlessly jeopardize life.

*The difficulties and dangers* attending the Neumann operation are, I believe, greatly overestimated. While my personal experience with this operation is limited, I am, nevertheless, convinced that when the technique is once comprehended the difficulties will vanish like snow in warm sunshine, and the dangers will be found to be only those attending any serious surgical disease. That is, the dangers will be in procrastination and temporizing surgical procedures, rather than in the performance of the Neuman labyrinth operation.

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#### DISCUSSION.

DR. A. GRAY, Glasgow:—With regard to Dr. Goldstein's paper I have not really very much to say beyond emphasizing with him the difficulty confronting you when dealing with sections of the temporal bone; and very often one has to see a slide ten or twenty minutes before you are sure of the anatomical relations. I must thank Dr. Goldstein for some of those slides he showed me, and I wish I could prepare some similar ones myself. Dr. Goldstein spoke about investigating pathological conditions in the temporal bone, and he hoped the time would come when we would be able to obtain these specimens within a few hours after death and be able to see what changes have really occurred in the organ of corti, etc., so soon after death. Well, gentlemen, so far as my own country is concerned, I am not sanguine upon this point. In many of our institutions postmortem examinations are not permitted until more than twenty-four hours after death, and it will probably be difficult to get such regulations removed. Perhaps, however, in special cases, we may be able to have them modified. I do not know what the conditions are in America; probably they are more flexible, and in that case now will have an advantage over us in your pathological researches.

DR. W. C. PHILLIPS, New York:—I sympathize with Dr. Goldstein in his attempts to impart what he knows regarding the minute anatomy of this minute and complicated bone. It is so difficult to gain the knowledge, and mere gaining of the knowledge does not automatically give one the ability to impart it.

I have very little to say regarding the paper of Dr. Ballenger except words of commendation. I only desire to bring out one or two corrections that have arisen from my study of this problem. It is a good thing in all the realms of medicine and surgery to have definite and positive rules to follow. A table has been shown you this afternoon, which is the table devised by Neumann and based upon his personal



experience. I made use of this table and published it in my text book. But I have put it in as Dr. Neumann's table, for I have the highest regard for any subject of which he writes. However, I have not yet reached the point where I am willing to take a definite abstract of signs and symptoms which are given in a table like this and cast away my long continued habit of giving due weight to other symptoms. In other words, I certainly should not invariably follow this table. I am sorry Dr. Ballenger has neglected in his paper to give due importance to the symptoms of temperature and the history of the individual case. I believe the Neumann table is worthy as a guide, but we must not forget that the better the rule, and the more positive that rule, the more important are exceptions, and these are not few. I have a case in mind which illustrates this very point. A young woman came under my care last year with the symptoms of acute purulent otitis media, with the drum membrane intact in an ear that had never been purulent before. I sent her to the hospital and asked one of the house staff to perform a paracentesis. The next morning an examination revealed a few drops of pus coming from the wound, an incision which had been carried directly into the field of the footplate of the stapes, accompanied by symptoms of irritation in the labyrinth. She had the most extreme vertigo, unable to get up and walk across the floor without help. She had no temperature. There was absolutely no hearing in the ear whatever, and I made the most careful test covering a period of weeks. In other words, her cochlea was not functioning and she had extreme vertigo; two indications that are given in that paper for immediate operation, because they came on suddenly. And she is here on earth and able, without operation, to go on with her duties as school teacher but with total deafness in that ear. I think I have fully emphasized the fact of my unwillingness in all cases and under all circumstances to go into a labyrinth and operate on these chart symptoms that are here given to the exclusion of clinical symptoms.

DR. A. H. ANDREWS, Chicago:—With Dr. Philipps, I believe these to be good rules, with the exception of No. 5, to which I believe there are so many exceptions that it is no good at all. No. 5 says that with no hearing, no functioning cochlea and the vestibular apparatus not functioning, without fistula and with or without nystagmus, we should operate. I want to report two cases. A young lady came to me some years ago, in whom I could discover no hearing in the ear, no vestibular reaction. She had had a chronic discharge from the ear for years, and had been unable to hear from that ear for years. I did an ordinary radical mastoid. She is well today; still no hearing. Now I believe Nature throws up a barrier there which you had better let alone. I feel very sure if at that time I had undertaken to extenuate her labyrinth she would have been the worse for it. Another patient, in whom while doing a radical mastoid, I accidentally removed the stapes. There was a discharge of intra-labyrinthine fluid, total loss of hearing, great dizziness which lasted for some time. I examined that patient a short time ago, and found no evidence of hearing or vestibular reaction, corresponding to rule No. 5; nothing was done; she is well today. I believe that rule is a mistake in a majority of instances.

Now with regard to examining the labyrinth and getting specimens early. I think in the state of Illinois we have no laws regarding the subject of autopsy within twenty-four hours. If there is such a law I have never heard of it. There are some of us connected with institutions in which, in connection with the superintendent, we can do the necessary post-mortem work, get the labyrinth and preserve it. It is not a difficult

procedure. All that is necessary is to remove the calvarium, go down with a broad chisel and lift it out.

DR. S. KOPETSKY, New York:—I congratulate Dr. Ballenger upon the inquiry he has made, but it seems to me that a great deal of the confusion which still exists regarding the cases upon which we shall and which we shall not operate, is due to the fact that due consideration is not given to the character of each individual case.

The chart presented by Dr. Ballenger here today in no way takes this factor, which I consider most important, into consideration at all. If that chart is applied to a labyrinthitis following an acute middle ear and mastoid involvement; and, is again applied to an acute labyrinthitis following an acute exacerbation in a chronic middle ear suppuration and mastoiditis; and, in a third case, is applied to a chronic labyrinthitis following a chronic mastoiditis, the results from applying the chart will be found differing in each class of cases, if applicable to some at all. This chart leaves much to be desired from the practical standpoint. I think the Vienna school too radical. I know that my personal experience is limited, but, from a close study of the cases I have had, I find no guide in what has today been offered, in finding the indication for operation.

There has been some progress since the last report before this Society on this subject. Today they tell us, regarding cases of labyrinthine fistulæ, you may or may not operate, as you choose individually. If there is no function, you shall operate. That it is immaterial, under the circumstances. But is it? I reported a case here last year which has bearing on this question of operating when function is absent. A young lawyer had an acute labyrinthitis. As far as all tests at our command show, he is deaf in the affected ear. He lateralizes to the opposite ear. Caloric tests also negative. I did not operate. He recovered. Examining him one year later I find he is beginning to hear some of the forks; the low ones are not yet heard. And I ask you, gentlemen, is Dr. Ballenger correct in saying that a patient would not be harmed, that it is immaterial, whether or not he has been subjected to operation? I think the conservative position is correct in regard to this matter.

I am glad Dr. Ballenger comes out so strongly with the fact that nystagmus is of no value. Baranay and many others have not taken into account the individual variation in the patients one examines. There is a certain per cent—I believe over 25 per cent—who have spontaneous nystagmus and have neither labyrinthitis nor any other cerebellar disease causing nystagmus. And what is said of spontaneous nystagmus is true to a greater or lesser extent of all the other symptoms of labyrinthitis. I criticized and made my observations public before you last year, and have yet to hear one logical contention against the stand I then took and still maintain. I consider some of the very tests, in certain contingencies, dangerous.

With reference to the case cited by Dr. Phillips, another factor might have been brought into play. I call that a case of serous labyrinthitis. If we study an ordinary furuncle, one sees a central portion of the furuncle, the infected area, and outside and around this center an area of œdema, and thus I believe, in a case of very virulent infection of the middle ear, that the area of œdema may reach a high degree in the adjacent part; that is, in the channels of the labyrinths and cause compression of the soft parts and nerve endings. In Phillips' case I think the nerve was destroyed by such a process of pressure. On the whole, in the face of both Phillips' and my own reports we ought not to operate, although to follow the chart, we both should have done so.

In latent cases, too, I do not want to operate until manifest signs demonstrate that recovery is impossible otherwise.

DR. J. R. FLETCHER, Chicago:—I want to say a word about Dr. Goldstein's paper in relation to getting early specimens. You must remember that the undertaker follows us very closely, and if we have allowed life to remain he will very soon extinguish it with the injection he makes, and therefore it seems to me it should not be difficult to get early specimens. Also, if we co-operate with him, he could very easily inject a vessel, which would retain the labyrinth for some time.

As much as I think of Neumann, and that is a great deal, it seems to me that this tale is entirely superfluous. It was gotten out by Neumann in 1907, when the whole question was relatively new. They had been studying especially nystagmus, and he has not modified it since that time. The first is simply a case of chronic suppurative otitis media, in which he considers the absence of fistula. The second is the same in the presence of fistula, and so on. He speaks of absence or presence of spontaneous nystagmus. He should say "spontaneous vestibular nystagmus" because spontaneous nystagmus does not mean anything unless we designate "vestibular." I had a patient two years ago illustrating that. He came to me with granulations extending out of the external auditory canal. He had spontaneous nystagmus. It was so rapid I could not tell whether it was vestibular or not. There was no slow component to be observed. With all tests we could make, he had no hearing in that ear, and he was very deaf in the other ear from chronic adhesive process, and claimed to have severe attacks of vertigo. The only means by which I could tell whether he had a diffuse suppurative labyrinthitis was by making the caloric test. With that I changed the character of this quick nystagmus. In other words, I used cold water and the vestibular apparatus responded. The nystagmus was horizontal and rotary to the sound side, with very much longer excursions, and unmistakably vestibular. I sent him to Dr. Suker, who found that he had coloboma of the iris and central cataract. The spontaneous was distinctly an ocular nystagmus, due to these eye defects.

The only indications for operation are those in which there is no hearing. This whole thing can be reduced to the rule: Do not operate when there is any hearing. Any hearing means hearing of any of the tuning forks.

Dr. Ballenger makes the statement that spontaneous vestibular nystagmus is no guide whatever. No. 7 is the only possible exception to the above rule, and it is there that nystagmus is the guide, because the rapid progress of the disease means the destruction of the functioning vestibular apparatus and cochlea, which would destroy the hearing and cause nystagmus to the sound side, and that is the indication for the operation. The presence of nystagmus is early in the disease. Absence may mean that it has subsided, and sufficient time has elapsed for adjustment. The history will show that he has had vertigo, nausea and vomiting; and, if so, our knowledge of nystagmus at the present time is insufficient to say that it was present. It seems to me that whatever has happened in the hands of gentlemen who are reporting only one, two or three cases do not make very much difference. In the statistics of Politzer's clinic they have studied hundreds of cases, and all these rules are based upon the greatest good to the greatest number. They find that in cases where the labyrinthine operation is indicated that the complete operation or none had better be done. When the complete operation was done the death rate was very distinctly less than in

unoperated cases. When the cochlea only was opened the death rate was greater than in the unoperated cases.

It must stand to reason that if we operate upon a series of cases after a given rule, there may be a few individuals who will lose this little remaining, relatively unimportant, hearing. The question is not one of hearing but of life and death.

Another thing which makes this chart useless is this: It is not worth a hill of beans in the two extremes of life. You can tell very little about the hearing in the very young and in the old. In such cases we can distinguish Nos. 7 and 8 by the caloric test, or wait for signs of brain irritation. We must not fail to remember the differential diagnosis between suppurative and serous labyrinthitis.

DR. W. L. BALLENGER, Chicago (closing discussion):—I read this paper because I think you need to hear it, and since you entered the discussion I am more than ever convinced that you need to hear it. I know that I needed it, and have been needing it in the past so badly that I have been embarrassed, and I hope that some of you will be placed in the same position and be glad to hear what I have said. Some of the gentlemen who discussed this paper revealed to me that they have not sufficiently realized the subject about which they are talking; and some of them have misrepresented the intent of the paper. Now without any more personal remarks I will proceed to take up some of the points brought out.

Dr. Phillips says that I did not present the general symptoms. My paper is not upon diagnosis. I am assuming that will be taken care of, and yet the fact remains that a patient with total deafness, with total loss of vestibular function and with suppurative disease of the middle ear, or perhaps with a total destruction of the labyrinth, must have attention, and if you are doing a radical mastoid operation the indications are to go on with the labyrinthine operation. The sudden development of vestibular symptoms he said was no indication for the labyrinthine operation, nor did I say it was. I said as to the rapid development or progression (not the sudden onset) that the case should be held ready for operation when the hearing function is totally destroyed. Dr. Kopetsky speaks of the character of the disease just as Dr. Phillips did, and I have already responded to that. He speaks of the Vienna school as being too radical. I do not believe, that is, I do not believe the Neumann school is too radical, and they do not operate on many cases—such cases, indeed, which I have seen Americans operate on. Some of the American confreres if we are to believe their papers, have been operating cases in which there is not the slightest indication for operation. Routine has brought out this fact and shown us the cases, in which there was total loss of hearing, in which there was afterwards recovery of hearing, as referred to by Dr. Kopetsky and Dr. Fletcher, showing they were not suppurative but serous disease of the labyrinth.

Now as to spontaneous nystagmus. My paper was criticized because I said spontaneous nystagmus had nothing to do with the indications for operation. I said that in 7 and 8 (see table) the occurrence of spontaneous nystagmus would have some influence upon the indications. With reference to Shibe's work, he reported some cases cured by the fixation treatment, with beautiful results. Dr. Shibe has since shown the pathological specimens of those cases, and thus taken away the glory of that method of treatment. Dr. Kopetsky also referred to latent cases. I said you do not operate when part of the labyrinth is left and the case is latent.



Dr. Fletcher's remarks were very well taken. I think he is very much mistaken, however, in saying that this table is absolutely of no value. It shows you just as distinctly as can be shown that there is one indication for operation; namely, if the patient is totally deaf, and has total destruction of the vestibular apparatus, the indications according to the table are positive. According to Rutine's work you may have temporary total deafness in serous labyrinthitis; hence, in rare instances total deafness may not be a positive indication for operation, that does not make the table absolutely certain. As I am one of the followers of the modified radical operation in America, I suppose I must rise to my feet, though I do not care to say anything about that particular phase of the subject at this time. I will simply say, however, that I have done the operation about fifty times, and that in nearly all of the cases I have cured the disease, and given the patient nearly normal hearing.

## SOME ANOMALIES OF THE MASTOID FROM A SURGICAL ASPECT.

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MILWAUKEE, WIS.

Some eight years ago, a case of double mastoiditis, complicated by an inter-communicating suboccipital sinus, came under my care. Since that time I have been greatly interested in the question of anomalies, or atypical conditions of structure of the temporal bone, which seem to influence to some extent the course of mastoid disease. In an extended review of the literature for the past five years, I have been able to gather but little of value from an anatomical standpoint, although many of the published case records are of intense interest from a clinical aspect.

In an article published two years ago (*Archives of Otology*, 1908), Mr. Arthur Cheatle gives the result of the examination of five hundred temporal bones, with many excellent illustrations of the more instructive ones. In Mr. Cheatle's paper great stress is laid upon the close association of the cellular structure of the mastoid, and the petrous portions of the temporal bone and of the liability of deeper involvement in the cellular types of bones, from the presence of a suppurative process in the mastoid. For my own satisfaction, I sought to obtain sufficient material for a careful study of the subject, but my efforts were disappointing. Some of the few bones that were obtained, however, have been sectioned in different planes and will be thrown upon the screen, as they seem to illustrate certain points of significance, taking into consideration the effects of destructive inflammatory disease, and the tendency to spread along certain lines.

From the dearth of post-mortem material, I have turned to my clinical records covering seventeen rather active years in mastoid surgery and have executed from rough drawings made shortly after operation the sketches to be shown, which, however inaccurate from an anatomical standpoint, will, I believe, serve their purpose. Before proceeding further let us consider briefly the question of what constitutes a normal mastoid? It is one not easily answered. We may all

subscribe to the statement that the normal mastoid apophysis is a projection of bone posterior to and below the external auditory meatus, furnishing attachment to the upper end of the sterno-cleido-mastoid muscle; that, externally, it consists of a dense bone structure of variable thickness closely associated with and part of the surrounding bone mass; internally, a cellular or diploetic structure, co-extensive with that of the petrous and squamous portions of the temporal bone and of the occipital; and lined with another layer of dense bone, usually much thinner. The upper area of the cellular struc-

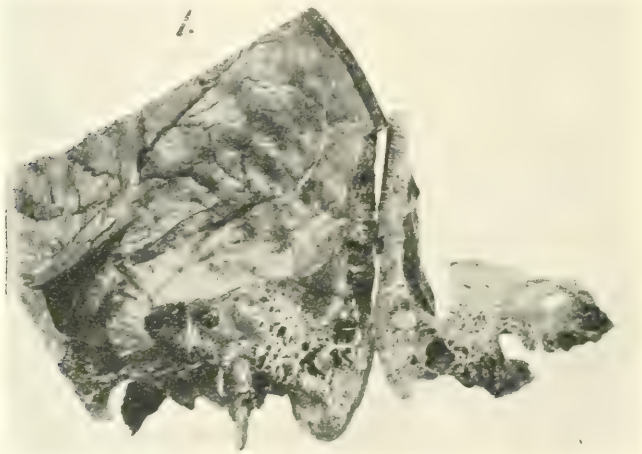


Fig. 1.

ture contains a cavity, the antrum that is practically constant and in direct communication with the tympanic attic. Now the form of this apophysis, and the internal arrangement of its cellular or diploetic structure are almost as variable as the types of the human race, and the ages of its individuals. In the discussion of the question of its anomalies, in view of this variability of structure and form, one might seem to be taking unwarranted liberty with the term. Nevertheless, as the surgical aspect of variation is one of such profound importance it has seemed to me to be a subject not unworthy of your consideration.

The rule that pressure developing in a septic process tends to find its way out along the line of least resistance, applies no more aptly than in suppurative disease in the temporal bone, and the recognition of this dictum implies also the

recognition of the possible lanes of travel, and the degree of virulence of the infecting agent. Excluding the latter from this discussion, a close study of the average adult temporal bone will show certain well defined tendencies in the mastoid development, e. g., in bones of the dense type, a thick cortex, comparatively small apophysis, with small cells deeply situated, and usually closely associated with the antrum, but with certain points of vulnerability, generally upon their inner

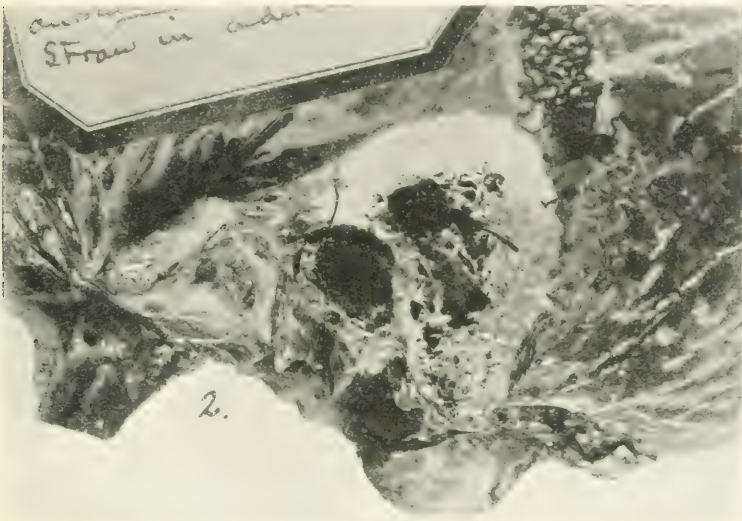


Fig. 2.

aspect. In the thinner walled type the mastoid is generally of larger size, oftentimes containing cells of considerable area, some frequently remote from the antrum, and occasionally exhibiting breaches, or extremely attenuated walls in some direction, e. g., in the digastric fossa, beneath the sigmoid knee, in the antral roof, and back along the old sutural line, the whole often in close association with the deeper petrous honeycomb. In some individuals this cellular structure will show marvelous irregularity, in others the cells are almost as regular in shape and symmetrical in their arrangement as a package of small quill toothpicks, pointing towards the antrum. Cheatele has pointed out that the development of these cells originates in the antrum, hence their blood and lymph supply is largely analogous. It is a curious fact that frequently in early operations, one finds septic involvement of



the cells far back in the region of the emissary vein, while the rest of the structure, excepting the antrum itself, is apparently untouched, and this is particularly true in the irregular type of cellular arrangement. Not excluding as carriers of infection the blood and lymph elements, by far the larger number of complications of mastoid disease is due to direct extension, the softened diploetic or cellular structure breaking down more readily than the denser bone of the two tables, so



Fig. 3.

that the sutural lines or vascular openings are the vulnerable points. For example, as perforation of the cortex is probably most frequent along the sutural line towards the apex of the supra meatal triangle, so too are epidural lesions commonest along the same line from causes that are perfectly obvious.

In the matter to be presented I have endeavored to select as illustrations only those which have appeared to show peculiarity either of structure condition which have suggested the possibility of, or which have actually developed some complication.

1. Cross section right temporal bone, one inch back of meatus, through apex of petrous bone, showing an extremely cellular structure with practically continuous cellular development extending from mastoid to petrous tip. This is the same bone which in another view shows the absence of the

attic roof, with a free communication into the middle cranial fossa.

2. Temporal bone of dense ivory-like character. The thick cortex is underlaid by considerable deep cellular structure which seems to radiate in whorl fashion from the antrum.

3. View of right middle fossa, showing perforation of attic roof. Please note the possibility of middle fossa complications in this case. Indeed, this specimen might have sug-

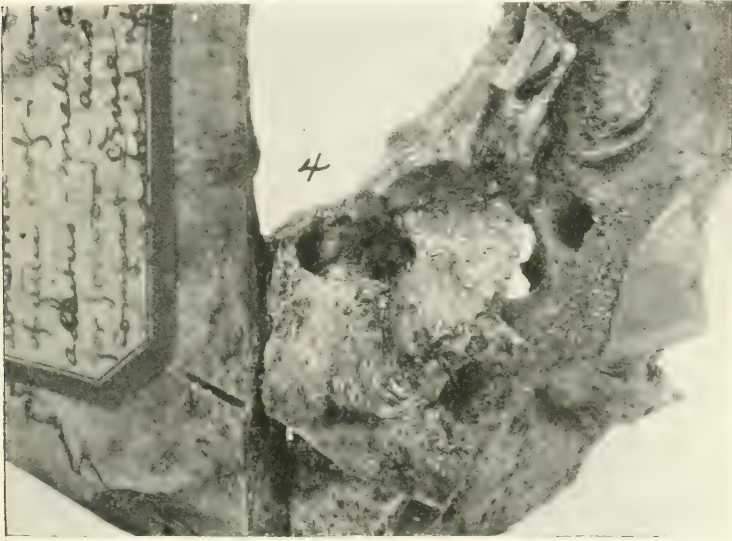


Fig. 4.

gested a pathologic process, had it not been disproved by the presence of the ossicles in an apparently normal state, at the time the bone was sectioned.

4. This was an attempt to show in cross section an extremely thin attic roof, in a temporal bone with a dense mastoid structure. This plate is a poor one.

5. This is a longitudinal section through a dense walled, small celled mastoid. The cut is one-quarter inch behind the meatus dividing the antrum and showing it to be practically a part of the cellular structure. There is no internal diploe in this case.

6. The same bone one-half inch back, but sectioned parallel to the last cut, showing diploetic structure external to and below fossa of Jugular bulb.

7. Longitudinal section through a thin walled temporal

bone one-eighth inch posterior to the external meatus, cutting across supra-meatal triangle and dividing the internal auditory meatus lengthwise. A very small antral cavity is shown, co-



Fig. 5.

extensive with the fine cellular bone structure of the mastoid, the inner table being extremely attenuated.

8. The same bone as the last, sectioned three-quarters of an inch behind meatus, paralleling first cut, and dividing a



Fig. 6.

large mastoid prominence in half. Each half shows a remarkably beautiful picture of the cellular mastoid type, and of the petrous cells of Cheate, directly beneath the sigmoid sinus. The posterior part of section shows extensive cellular

development to the margin of the lambdoidal suture. This piece shows also one of twin openings for emissary vessels.

9. Sketch, E. C., age 7, acute mastoiditis left ear follow-



Fig. 7.

ing measles. Cortex perforated at apex of MacCuen's triangle. Epidural pocket encountered by following suspicious lead along masto-squamosal line.



Fig. 8.

10. Sketch. Mrs. H., age 57, acute grippal mastoiditis of unusual type. All the part shaded vertically was cancellous



tissue, the diploetic contents being in state of cloudy swelling. This was completely removed. A trace of pus was encountered in this antrum. As the patient had suffered intensely and showed more than the usual temperature reaction, further search was made, and soon developed the presence of the large pocket in the petrous cell, as shown in the portion shaded horizontally.

11. Acute mastoiditis. A vertical line dropped through the posterior wall of the external canal shows one-third of the

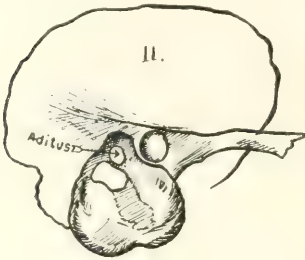


Fig. 11.

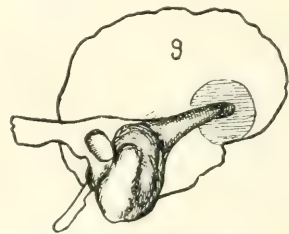


Fig. 9.

apophysis anterior to this line, and directly below the external auditory meatus. The lateral sinus was exposed by the disease, and lay about as shown in the sketch, with the jugular bulb clearly outlined at its deepest point.

12. Represents a radical operation upon a tubercular child of 2 years of age, who one month earlier had developed an acute infection of the left ear. Before being brought to the hospital, a Wilde's incision had been done, and a copious thick

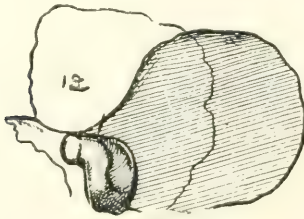


Fig. 12.

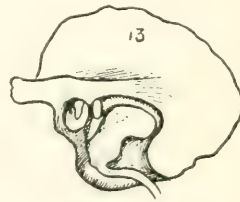


Fig. 13.

foetid pus was discharging from this, and a spontaneous opening anterior to the meatus, and also from the external canal. A sphacelated outer table was removed in a blanket, looking not unlike diphtheritic membrane, and measuring about three inches in diameter.

13. Girl aged 11. Acute mastoiditis with typical thrombotic temperature and history. Operation, Schwartz. Septic sigmoid sinus thrombosis. Primary resection of internal jugular. The sigmoid knee was exposed in MacCuen's triangle, one-eighth inch behind posterior wall of meatus, with an antrum of fair proportion lying directly inward. The lateral sinus was choked with a current jelly clot. The sigmoid near bulb was filled with a thick foetid purulent clot. The emissary vein measured one inch in length in its passage

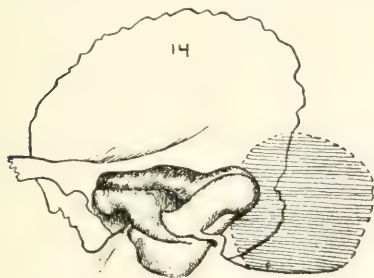


Fig. 14.

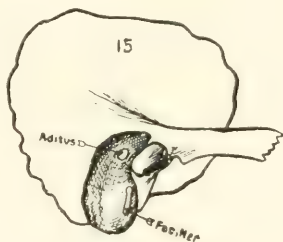


Fig. 15.

through the bone and was thrombosed. Excepting for impaired hearing, recovery was complete.

14. C. R., boy aged 11. Chronic suppuration left M. E. 9 years duration. Recurrent attacks of suppuration R. E. Was brought to hospital in a state of wild delirium, with the history of a fall, 24 hours earlier, which however had not interfered with play. Chill occurred the same night, with a left facial palsy. Within the hour of his arrival, radical operation

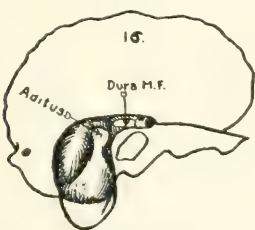


Fig. 16.

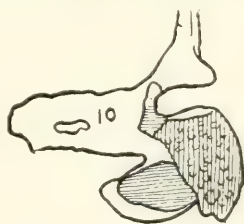


Fig. 10.

was begun, with resection of the internal jugular and opening of sigmoid sinus. Findings: Chronic suppuration left middle ear; cholesteatoma in antrum, and septic sigmoid sinus thrombosis, the lateral sinus being the horizontal axis of a large epidural abscess. Death three weeks later was shown by

autopsy to have resulted from spinal meningitis due to the rupture downward into the spinal canal of a half suspected, but unlocated, deep-seated cerebellar abscess. One other feature of this case developed at the autopsy was the presence of a small area of septico-plastic meningitis around the internal auditory meatus, which probably developed by extension along the fallopian canal at the time facial paralysis occurred, and from which point undoubtedly the deep cerebellar process began, the autopsy showing that the region operated was rapidly progressing to recovery.

15. This might be designated a reasonably normal type were it not for the unusual feature of the exposure of the

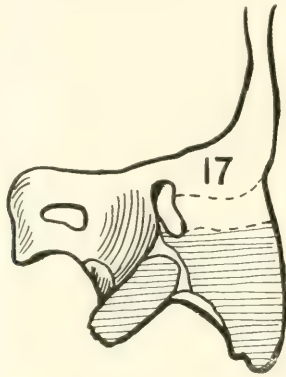


Fig. 17.

facial nerve for a distance of one-quarter inch within the apophyseal cavity at the site designated. This was determined positively by the effect of repeated irritation, with the characteristic facial reaction. Fortunately no palsy resulted.

16. The only unusual feature of this case was the development in a young married woman during an apparently mild attack of grip, and with very trivial acute middle ear symptoms, accompanied by a small amount of purulent discharge. The individual in question during the time never experienced pain and but little physical discomfort aside from deafness. The range of temperature, taken thrice daily by a competent nurse, was between 98 and 99. At the end of three weeks from the onset of the attack, and after she had apparently entirely recovered, a swelling appeared forward of the tragus. The mastoid was immediately opened, and was found to be completely exenterated and filled with flabby granulations. The cortex had spontaneously perforated at

the point indicated in the zygomatic region, and the dura of the middle fossa was found laid bare by the disease.

17. Record note says this is the largest cavity I have seen, and has the additional unusual feature of a separate pocket in the petrous cell, not unlike a previous sketch, with the exception that the apophysis in this case was completely exeneterated by the disease, and was separated from the secondary cavity by a fairly thick hard bone, from which, however, at one point a lead exuding pus indicated its presence.

18. The pre-operative diagnosis was sub-acute mastoiditis plus a probable epidural abscess. Male, aged 25. This diagnosis was based upon the history of continued pain at the point far back of the auricle, headache, mastoid tenderness, copious sanguino purulent discharge from the meatus, but

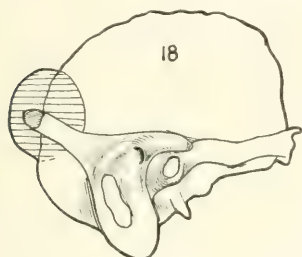


Fig. 18.

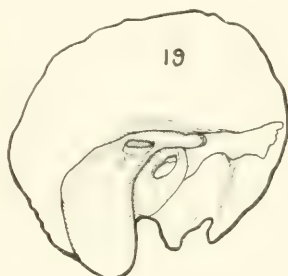


Fig. 19.

particularly upon the presence of choke disk. At the time of operation, there was no evidence in the mastoid of backward extension, but exploration along the old sutural line in the direction of the site of pain uncovered a large pocket of pus under considerable pressure, at the point indicated in the sketch.

19. Astute mastoiditis (right) plus brain abscess, operation and recovery. Three weeks before mastoid was opened the patient had submitted to a minor pelvic operation, and subsequently developed a severe attack of grippe with involvement of both middle ears and the right mastoid. Operation for mastoiditis was done on the fourth day of the disease. The apophysis was completely infiltrated with pus, but no cellular destruction had occurred. Bacterial findings: Streptococci in the right ear, staphylococci in left ear. The only feature peculiar in this case was that in opening into the antrum through the supra meatal triangle, a cavity was encountered filled with pus, under some pressure. A bent probe inserted in the proper direction



entered the aditus, but upon being rotated upwards and backwards touched denuded dura at the site of antral roof, as is indicated in sketch. The absence of antral roof was probably not due to the disease, as the attack had not existed sufficiently long to lead to any cellular destruction in the apophysis. It was clearly not due to operative interference as it was in a region sufficiently remote to justify this assertion. It is my belief that there was a pre-existing absence or excessive thinness of the inner table not unlike one of the anatomical specimens exhibited here. The exposure of the dura in mastoiditis is not necessarily a matter of any particular consequence, but in the case at point the concurrent development of an abscess in the temporo-sphenoidal lobe opens up the question of whether this was not the probable path of invasion.

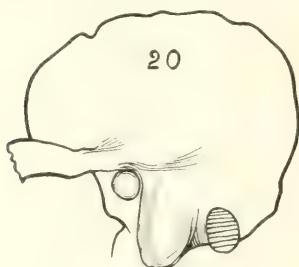


Fig. 20.

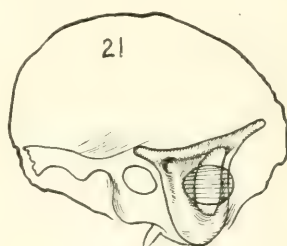


Fig. 21.

I might add that the pus from the brain abscess, operated one week later, was identical to that in the right mastoid, viz., streptococci. This case will probably be reported in detail.

20. One of the three similar cases operated at an early stage of the disease, where the only focus of destruction was at the site indicated, directly beneath the sigmoid knee. There was pus in the middle ear and also in the antrum. Pain was most marked over the focus mentioned. A very cellular mastoid seemed to entirely escape the infection.

21. Miss K., woman aged 52 years, operated two years previously for right-sided mastoiditis. She was brought last April to the Columbia Hospital with an acute otitis media in the left ear. The symptoms were unusually mild, afebrile, and free from mastoid pain or tenderness. At the end of three weeks the condition had so far improved as to permit of her discharge from the hospital. The night before she was to leave, following a chill, the temperature rose to 103 and a fraction, with the development of a point of tenderness in

the region of the emissary vein. The mastoid was promptly opened and a small focus of disease as indicated in the sketch was encountered directly below the knee of the sinus, the vein being bathed in pus at this point. The rest of the bone seemed free from inflammatory change. There was apparently no indication of a clot in the vein and it was not opened. Her condition steadily improved for three weeks, when she developed a phlebitis in the left leg, and one week subsequently in the right. Recovery finally resulted, with no other untoward symptoms.

#### DISCUSSION.

DR. A. GRAY, Glasgow:—I must be allowed to say a few words of purely academic interest in regard to variations in the mastoid process. These variations give us much annoyance, but aurists do not seem to take much trouble in finding out why they occur. The reason they occur lies in the nature of their evolution. It is a common biological law that a structure that has been recently evolved will be found specially liable to variations. The mastoid region is an example of this. In addition to man there are only four species of animals that possess a mastoid process at all—the gorilla, the chimpanzee, the orang outang and the gibbon—and it is because of this very recent acquirement of the mastoid process that there are such remarkable variations in it. Here is another interesting fact. We know that in the infant there is no mastoid process at all. The reason for this depends on another biological law—the more recently a structure has been acquired, the later it appears in the individual development. Hence, in the new-born babe the mastoid process has not yet appeared. Another interesting fact is this; if you take the skull of any animal, except the anthropoid apes just referred to, you will see a large semi-spherical bulla, as it is called, opening off the middle ear, and you will be apt to think what large antrums these animals have. Now this bulla is not analogous to the mastoid antrum. It is a large air cavity, and possibly serves the same function as the antrum. In the anthropoid apes and in man, the bulla diminishes in size until it becomes the small cul-de-sac which runs back below the oval window towards the ampulla of the posterior semi-circular canal. Now the reason we know this is, from the disposition of the facial nerve in the two groups of animals. In the anthropoid apes and man the facial nerve lies internal to the mastoid process, whereas in the lower animals the facial nerve comes out external to the bulla. Until quite recently the idea prevailed that the bulla represents the mastoid antrum. It probably does so functionally, but has no analogical relation to it at all.

In my paper I referred to a lady who was 101 years old when she died. That was an interesting case in another respect. I had read of cholesteatoma occurring in the ears of patients who had no perforation of the membrane. I must confess I had been somewhat skeptical about such a condition until I made the postmortem examination on that old woman. The whole of her mastoid antrum and middle ear was packed full of a cholesteatomatous mass, and yet, there was no perforation and no trace of any previous supuration. The condition may have gone on for decades. I do not know whether any of you here have made postmortems with similar results. A cholesteatoma can occur in an antrum with a perfectly intact drum membrane.

DR. OTTO J. STEIN, Chicago:—I want to mention in connection with this paper the reading of Beyer's report of double sinus that he found. I ran across one case in operating. I never had the opportunity to work it out or verify it, because the patient lived. Another point I want to mention in connection with this paper as an anomaly of the mastoid process, and that is the very unusual anomalous course of the facial nerve. I have never seen this in actual life, but I remember a specimen shown me by Dr. Berrens of New York some years ago where this nerve passed in its course through the facial ridge directly in the posterior part of the bony canal, and it would have been an absolute impossibility to have done a radical operation without injuring that nerve, and I always think of that particular specimen in doing a radical operation.

DR. C. M. ROBERTSON, Chicago:—In one mastoid bone in my collection an anomalous position of the superior petrosal sinus is shown.

In this specimen the superior petrosal sinus enters the mastoid cells, passing through the cells, with no bony covering, entering the cranium again, just before it enters the lateral sinus, through a well defined foramen.

It would have been destroyed in this case had a simple mastoid operation been done.

Another case, belonging to Dr. Mosher, in which he had done a mastoid operation on one side, and where there was suppuration from both ears, he found upon syringing the ear he had operated upon, that the solution came out the ear on the opposite side, showing the communication through the petrous portion of the two temporal bones.

DR. S. IGLAUER:—There is one method of discovering these anomalies in the mastoid which was not mentioned in that paper; I refer to radiograms taken during life. Some two years ago I reported on this subject. If one takes radiograms before operating one can determine the type of the mastoid, i. e., whether the mastoid is diploic or sclerotic; one can locate the position of the sigmoid sinus and tegmen tympani and in addition one can often determine whether the bone is broken down, or whether an abscess cavity is present. Dr. Hitz' paper simply confirms my belief that these radiograms should be taken, because one can control operations beforehand. At the time I first reported on this subject I was not certain whether one could detect acute mastoiditis, but since that time I have often determined to operate from the evidence presented in radiogram. If one takes several radiograms in the course of a week or two, one can determine whether the disease is progressing or tending towards recovery. I have found that the normal mastoid radiogram is the same on both sides of the skull, but where there is a difference in the mastoids it usually means that sometime during the lifetime of the patient there has been an inflammatory process in the mastoid. The radiogram tends to prove that the mastoid is the same on both sides unless there has been some inflammatory process to change the natural course of events (in a child) or, to bring about a change in structure (in the adult).

DR. W. L. BALLENGER, Chicago:—I want to report the observation of a very interesting specimen in the possession of Dr. Wales of this city. In this case the mastoid cells communicated with the sphenoidal sinus, so that when you irrigated the ear the water ran out through the nose.

DR. S. KOPETSKY, New York:—In regard to the anomalies of the mastoid, I want to call the attention of the members of this Society to

a specimen I have in my possession, and since which, in looking over anatomical material, I have found two others, in which the mastoid process from the external surface is perfectly normal, the landmarks on it developed fully, but there were no mastoid cells at all in it.

The case that brought this to my attention was a very unfortunate one; it came to autopsy unrecognized as a sinus thrombosis, and the autopsy revealed what was supposed to have been the mastoid process was the outside plate and the cerebellum took up the entire inside area except that of the antrum, but no other cell was developed at all. And, I have never been able to determine how one could tell such a mastoid process before operation, unless one would resort to the procedure that Dr. Iglauer has suggested; namely, of having a radiogram made as a routine measure in all cases.

DR. C. M. ROBERTSON, Chicago:—If you will observe the markings of the lamina cribrosa on the surface of the mastoid bone, you will always have a guide to the absence at least of the lateral sinus, as there are always air cells as extensive as the extent of the lamina cribrosa.

DR. JOS. BECK, Chicago:—The last speaker touched upon a point which I must disagree with from practical experience as well as from radiographic examination, that is the point so far as the lamina cribrosa. I wish to speak about the value of the radiogram, one point Dr. Iglauer did not bring out. There are differences between the two sides. One authority, Hakasa Kanusugi, has found quite a large number of anomalies between the right and left side, and I have found them in making radiographic examinations quite often. There are anomalies. I have found in one case in the first 300 cases I examined, and now in the last forty cases I have found two more where one side is diploic and the other side pneumatic. I was glad to hear Dr. Gray speak of this bulla in lower animals, because I showed radiograms of this bulla last year, which I called a large mastoid process.

DR. A. H. ANDREWS, Chicago:—In the examination of a considerable number of mastoids on the cadaver I find as a general rule that there is a similarity between the two sides, but there are so many exceptions that when we come to operating the rule is worthless. I have had a number of cases in which the lateral sinus would be very superficial on one side, and on the other well back and deep. I do not know how to account for these anomalies. I want to mention the subject of transillumination as a means of diagnosis. I have watched a number of these cases in which during the first few days of the disease light passed freely through the mastoid, then as the disease progressed it would become darker, and where the patient would not recover the mastoid would remain dark by transillumination. Transillumination very frequently gives an idea of the position of the sinus. I think the transilluminator should be used oftener than it is in the diagnosis of these anatomic as well as pathologic conditions.



## PROGNOSIS AND TREATMENT OF TUBERCULOSIS OF THE LARYNX.

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NEW YORK, N. Y.

In looking backward over a period of some twenty-five years, one of the first topics in which the writer took a scientific interest was laryngeal tuberculosis, which still interests him greatly. Our views in regard to the prognosis of the disease have changed materially. As late as 1880 and 1881 Krishaber, of Paris, pronounced the absolute incurability of laryngeal tuberculosis, and the medical world rested under the shadow of that pessimistic view up to the time when Hermann Krause, of Berlin, published his observations with lactic acid, and Heryng, of Warsaw, his results with the curetment of the larynx. From then dates the beginning of a new era, a period of greater hopefulness as to the outcome of laryngeal tuberculosis. Having been an assistant in the clinic of Professor Krause at that time, i. e., in 1885, the writer's statements are based to a great extent upon his personal experience. Very soon a third laryngologist joined the ranks of the optimistically inclined, viz., Moritz Schmidt of Frankfurt-on-the-Main. It was due to the efforts of these three that a greater interest was taken in laryngeal tuberculosis. Through the aid of many others that degree of prognostic optimism was reached with which the writer would like every laryngologist and every general practitioner to be imbued. For, it is especially the latter who still clings to the views of Krishaber, to the ideas of the pre-cocain and the pre-laryngological era, i. e., those of hopelessness.

We have all reason nowadays to be optimistic in many cases of laryngeal tuberculosis, for the cures that have been achieved are no longer the exceptions. Unfortunately, the writer is not in a position to give statistics of all the cases seen or treated by him, since this would involve a much greater sacrifice of time and labor than he is at present able to give. But from experience we have learned many lessons, which will be presented in this paper.

The first one is that the curability of tuberculosis of the

lungs depends very much upon the cure of the laryngeal condition, and the curability of the latter in many instances upon the removal of lesions of the air tract above. In every sanatorium for tuberculosis patients, each and every newcomer should be examined as to the condition of his upper air tract and, if necessary, be treated accordingly. We know that such a little thing as a post-nasal catarrh may keep up an irritating cough which will not let an ulcer in the larynx get well, and that again will act as a source of irritation to the lower respiratory tract.

That even minor operations on the nose and throat should be performed with great conservatism and equally great care as to the loss of blood, etc., is a rule established in those institutions with which the writer is connected. Major operations are done only in case of extreme necessity, as they render the prognosis always doubtful. When care is taken of the upper air tract the prognosis of laryngeal tuberculosis assumes a different aspect. This is especially noticeable in cases in which we have primary manifestations of tuberculosis in the larynx, in other words, those in which clinically a tuberculosis of the lungs cannot be demonstrated. Here a diagnosis is difficult and often arbitrary. The prognosis is quite good if patients are placed in the proper climate and under proper treatment.

There is, however, one distinct class of primary tuberculous affections of the larynx to which I should like to draw your attention—that presenting laryngoscopically the appearance of pachydermia of the larynx.

Therapeutically a great deal can be accomplished in these cases if their true nature is recognized at an early stage. But herein lies the difficulty. Laryngoscopically you obtain a picture that may indicate lues, or carcinoma, or it may resemble pachydermia. This is not the place to go into the differential diagnosis of these affections, although the writer feels tempted to do so, as pachydermia of the larynx is mentioned but rarely nowadays. Suffice it to say that not infrequently cases have been treated for a specific laryngitis when all of a sudden the pulmonary tissue has broken down, and within a remarkably short time the patient has succumbed to pulmonary tuberculosis after the typical symptoms of tuberculosis have shown themselves in the larynx as well. On the other hand, the writer remembers three distinct cases presenting the pic-

ture of pachydermia of the larynx that have been cured permanently. In these the lungs were examined and incipient tuberculosis found. Ordinary treatment brought about the cure.

I would therefore urgently advise examining the lungs in every case where there is the least doubt as to the diagnosis of the laryngeal condition. Then, when tuberculosis is found and the patient treated accordingly, the prognosis in many instances is not bad.

Much graver is the outlook in secondary affections, but again I repeat, by no means hopeless. It is here that experience and great perseverance count, and occasionally they will be crowned by success even in apparently hopeless cases. Although the extent of the process in the larynx and lungs is not always the same, the one depends upon the other for a cure. If the pulmonary condition is rapidly growing worse, the patient will go down in spite of all therapeutic efforts directed to his larynx. Again, if the laryngeal condition is far advanced and the patient is unable to swallow food, his pulmonary affection, though limited, will progress and other parts of the lungs will break down. Naturally, there are exceptions to every rule, and to this one as well. An ulcer in the larynx may become cicatrized and the whole laryngeal condition healed, while the process in the lungs takes a contrary course.

Whether primary or secondary, the lesions are either localized or diffused, and that is of important prognostic value. At the same time the character of the lesion has to be reckoned with, and the manner in which the vocal apparatus acts upon the invasion of the tubercle bacilli (Portela). When pulmonary tuberculosis is complicated by pregnancy the outlook is not good; it is absolutely bad when the larynx is affected. Kuttner of Berlin, the writer\* and others have dealt with that topic, and all, with very few exceptions, agree as to the unfavorable prognosis in these cases.

But taking all the forms of laryngeal tuberculosis together, and reviewing the publications of men like Heryng, Finder, Grünwald, Krieg, Beck of Chicago, Jobson Horne, Robert Levy, St. Clair Thompson, Mermod, Tapia, Spiess, and others, it is the consensus of opinion, in which we coincide, that with our modern means of treating laryngeal tuberculosis the out-

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\*Wolff Freudenthal: The Baneful Influence of Pregnancy on Laryngeal Tuberculosis. *The Laryngoscope*, December, 1907.

look is by far better than it was twenty years ago. Indeed, if the so-called phthiseo-therapists had not stood still during that period, resting on the laurels of H. Brehmer and Dettweiler, but had advanced the way laryngologists have done, the prognosis would have been still more favorable.

Coming now to the second and more important part of our theme, the therapy, it is not our intention here to repeat what we said only a short time ago,\* but rather to endeavor to look at the disease from a different and perhaps new standpoint. Thus the question arises: What can we as laryngologists do in order to cure laryngeal tuberculosis, and thus exercise a beneficial influence on pulmonary tuberculosis? The answer is: Stop the cough, remove the dysphagia and occasionally also the dyspnea. This advice is easier given than acted upon, but it is by no means impracticable. If we begin with the first mentioned symptom, the *cough*, it is clear *a priori* that a cough originating in the lungs will exert a very bad influence on any ulceration in the larynx and pharynx. For every attack of coughing will mechanically irritate an ulcer in the larynx, it will stretch it, pull it, and make it less resistible and less prone to heal up. But now the question arises: Does a cough in pulmonary tuberculosis necessarily always come from the lungs? The conception of tuberculosis is so intimately connected with the cough that not only laymen, but also physicians, frequently say: In such and such case there is no cough, ergo there cannot be any tuberculosis present. This is decidedly erroneous as regards incipient cases, and these, I dare say, are never accompanied by cough unless it is produced by some infection in the upper air tract. You have all seen cases in which hemoptysis has occurred without any warning and, as a rule, without any pulmonary cough. This proves that whatever secretion there may be in the beginning of the disease is brought up into the trachea during the night by the mere action of the ciliated epithelia which swing in an upward direction. In the trachea it may lie until morning, when it is expelled by a single clearing of the throat. During the day the secretion is so slight that it is not noticed. In advanced cases the secretion is too abundant for such an occurrence, and besides the epithelia are gone to a great extent. Now, if the cough does not originate in the lungs,

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\*Wolff Freudenthal: Laryngitis Dolorosa. Annals of Otology, September, 1910.



where else does it come from? If you examine such patients you will surely find a laryngitis or a post-nasal catarrh or other lesions in the upper air tract to which it is directly due. By treating these conditions you will see how quickly sometimes a "lung" cough will disappear. For that reason I advocate a laryngological department in every sanatorium. Every patient, whether he complains of the throat or not, ought to be examined and, if necessary, treated regularly and thoroughly.

And here I will say, I am a great believer in climate. When a catarrhal condition of the upper air tract does not improve after thorough treatment, or when it even gets worse, then lose no time, but send the patient to a different climate, a higher altitude, a dry climate or the seashore, just as the condition may require. By all means stop the cough in the beginning when it is easier to accomplish it than later on. *Principiis obsta*. The fight against the cough is the most important part in the treatment of incipient pulmonary tuberculosis, and that part of the battle should and can be won by the laryngologist.

When, however, infiltrations have set in and ulcers have appeared, even then climate or local treatment may do a great deal in curing these cases, but alas, that is not the rule. Too often only do we encounter cases in which it is impossible for the patient to secure any rest on account of the incessant laryngeal cough and in which the swallowing of food is extremely painful, rendering life a great burden. Even here, when the process is not diffuse, but circumscribed, when ulcers are present, the use of the galvano-cautery point does good.

Elsewhere I have spoken of the drugs to be recommended for dysphagia, and I may mention here that the use of cocain is decidedly contraindicated. We do not want an anesthesia of the larynx, but a *prolonged analgesia*, i. e., one lasting for days. That can be produced by orthoform, anesthesin, or propæsin. The formulas used by the writer are given (*loc. cit.*). Nor have we changed our opinion in regard to the injection of alcohol. There will always be found ulcerations which we cannot reach by intralaryngeal applications of powders, sprays, emulsions, etc., and for these injections of alcohol are to be tried by all means. They are somewhat painful for a few minutes, but when the initial pain has subsided a euphoria takes place and an analgesia sets in lasting in some cases

five or six days, and even more. It requires a little experience to make these injections properly. If the needle is inserted too deep, the alcohol will get into the pharynx; if too superficial, it will not reach the *nervus laryngeus sup.*; a sure sign that you have struck the nerve is the intense pain. Avellis and Adolf Blumenthal of Berlin have recommended the resection of the nerve, and that seems to be feasible in exceptional cases only.

Brünings advised the application of Roentgen rays through direct laryngoscopy. I have had no experience with this method.

#### FULGURATION.

During last winter I employed a new method that will now be described. The way I came to use it was through the following case:

H. S., an inmate of the Bedford Sanatorium for Consumptives, presented himself with a subglottic tumor that could not be reached by any instrument known. Consequently I tried to act upon it by means of fulguration. Under that treatment the mass disappeared gradually and the result was excellent. The constant irritation that he felt before was gone and the voice became clear after the reaction had subsided.

Removal by this means of benign growths from the bladder had been done before, but this, as far as I know, was the first time in which it was used for this purpose in the larynx. Having seen the caustic effect so clearly in this case, we were naturally led to assume that the influence of fulguration on ulcers of the larynx would be equally good. As we can regulate the strength and duration of the application we were able to always regulate it according to requirements. The first case, the history of which I regret to say was lost, showed superficial ulcerations on the epiglottis and one aryepiglottic ligament (I write from memory). This patient improved so rapidly under fulguration that I thought it the best thing I had ever struck in laryngeal tuberculosis.

After that, I tried it in a more pronounced case of ulcerative laryngitis. The patient gave the following history:

Mr. F. L., 54 years of age, wine merchant, has had trouble with his throat for fourteen years. He is now absolutely aphonic, has severe dysphagia and has suffered from pulmonary tuberculosis for about a year. After having consulted quite a number of physicians he was finally referred to me.

*Status præsens.* Patient is very weak, coughs and expectorates incessantly. Both upper lobes of the lungs are much affected, and the larynx is in the following condition: Perichondritis of left arytenoid, infiltration (also subglottic) of left vocal cord; deep ulcer of right vocal cord covering almost its entire length, and ulceration on the posterior laryngeal wall with protruding infiltrations. He received injections of the propaesin emulsion, and commenced to feel easier; could eat and sleep somewhat better, but progress was very slow.

December 7. Injection of monochlorphenol, which was painful and of no apparent benefit.

December 13. Injection of alcohol which was followed by great relief, lasting about ten days.

December 25. Another attempt with monochlorphenol, which again was unsuccessful. He then went to Asheville, where he was under the care of Dr. von Ruck, returning to New York in May much improved. His voice was no more aphonic, but still quite hoarse. There were ulcerations on the right vocal cord and the posterior wall. At this stage I commenced to employ fulguration. It was applied every second or third day for several weeks, when the ulcers disappeared. He was again aphonic, which was due entirely to the reaction. He then went to Saranac Lake, where he was under the care of Dr. Lawrason Brown. His whole condition improved steadily, and without any local treatment his voice grew stronger every day, so that when he returned to New York City in the beginning of September he spoke with a loud sonorous voice. No sign of ulceration.

It is my conviction that the restoration of the laryngeal functions was entirely due to fulguration. Of course, the beneficial influence of climate in Asheville and Saranac Lake was evident.

The mode of application is simple. If you have a high frequency current in your office you connect it with any handle. To that handle you attach a wire that is covered with hard or soft rubber which can be bent to suit the individual larynx. The current is turned on by an assistant only when your wire is in situ, or by means of a foot switch. Several applications of a few seconds' duration are enough for one sitting. The spark must be visible in the larynx or else no effect is to be expected. Consequently when the patient gags or closes his larynx it is necessary to interrupt the application.

The benefits of this new method seem to be manifold. First, there is a mild caustic effect that destroys the ulcer (or infiltration). Second, one need not be so careful as with the galvano-cautery in trying to hit a certain point which occasionally is difficult. Although I always direct the sparks towards the affected spot, I am well aware that they spread all over the larynx. This is another advantage on account of (third) the antiseptic effect of the ozone produced by the current. Fourth, the ease of administration makes it also preferable to other methods. Five, there is no danger of an edema, as happens occasionally after the use of the galvano-cautery. A reaction sets in, but it is never of such a character as to produce dyspnea.

I have another patient with tuberculous ulcerations in the larynx who improved remarkably quickly under fulguration, but he had to leave for the mountains on account of the heat in New York. He will return shortly, as he is desirous of getting again the fulguration treatment for his throat trouble. There is every chance that he, too, will be perfectly cured.

These cases are so satisfactory that I expect a great deal in future from the fulguration treatment, and I feel I am justified in recommending it to my colleagues.

It was the writer's intention to speak in this connection of the surgical treatment of laryngeal tuberculosis, but as a paper with that title is to be read here today, I shall bring out whatever I have to say on that subject in the discussion.

Gentlemen, you have heard my first plea in regard to the establishment of throat clinics in every sanatorium for tuberculosis. My second appeal is to the directors of the sanatoria for the poor not to reject patients with laryngeal tuberculosis. It seems to be the irony of fate that we physicians should treat patients with incipient lesions who have no expectoration and even doubtful cases in the sanatoria for the poor, while those that are most dependent upon us are the greatest burden and danger to their families should be rejected because the old idea still prevails that we can no longer help them, while in reality we could do a great deal for them. A unanimous decision by this Academy would go far towards improving the present conditions. Expensive sanatoria should not be built for incipient cases. But patients with laryngeal tuberculosis and those with advanced lesions need all the resources of modern medicine and all our skill and attention.



## DISCUSSION.

DR. JOS. BECK, Chicago:—There are several points of interest and importance in this paper. I have had some little experience with all the methods of treatment outlined by Dr. Freudenthal, but they are not as good as the doctor's. We know of the painstaking efforts of Freudenthal, and we must take this into consideration as an addition in the treatment of laryngeal tuberculosis. Let me say a word in regard to the sanatoria which have been built for incipient tuberculosis. The fight is universal for the prevention of tuberculosis, when as a matter of fact the laryngologists have to do with the treatment of bad cases. I had a case sent back from Denver just the other day, because it was said there is nothing to be done for the fellow. As a means of relieving cough and pain in the ulcerative stage, alcoholic injections into the sup. laryngeal nerve has proved the most satisfactory method of relieving the pain and cough I have used. Some two or three years ago when Dr. Freudenthal was in Chicago, I was using the high frequency current for all sorts of affections, and not until the paper read by Keating-Hart on fulguration did I have any benefit from the high frequency. The many fine sparkings produce a sort of cooking of the tissues. But, it is painful in spite of surface cocaineization in the majority of instances I have tried it. Really I try never to treat these cases. These two points, the use of alcohol injections and fulguration, appeal to me very much.

DR. L. W. DEAN, Iowa City:—I want to say a few words before the others because I have a question to ask. While it is not a question of prognosis, so far as laryngeal tuberculosis is concerned, nevertheless it is of great importance. It is the question of early diagnosis of tuberculosis of the larynx. If we have, Mr. President, a large number of cases of incipient pulmonary tuberculosis gathered together in a sanatorium, as we have in Iowa City, necessarily there will be many acute cases of laryngitis. In these cases of acute laryngitis with the usual typical findings I know from a study of many cases that the large majority of them are cases of acute laryngitis and will get well in the course of a few days with simple treatment; about one-third of these cases will not get well and are cases of tubercular laryngitis. Now the question is, how are we going to tell which are the tubercular cases in the first few days where the patient complains of hoarseness, and practically nothing else, and when the appearance of the larynx is identical with what we find in simple acute laryngitis? Or, is there no way we can tell the one from the other? I have been unable to differentiate them in spite of very careful study. The tubercular cases if watched in the course of from three to fourteen days will develop some interference with the motion of the cords, a little synovitis or localized swelling, which then makes the the diagnosis clear. We have solved the problem in a way by treating all of these cases of acute laryngitis on the basis that they are a beginning tubercular laryngitis. Now, this thought has entered my mind that very many of these cases of tubercular laryngitis apparently following simple acute laryngitis are nothing more or less than cases where the resistance of the larynx has been lowered and the invasion of the germ has taken place. I would like to hear from the essayist and others on this subject.

What I say regarding the prognosis of tubercular laryngitis, I wish to confine to favorable cases. In our sanatorium favorable cases are prohibited from staying in the sanatorium by law, and we only have cases with moderate lung involvement, where the tubercular lesion in the larynx is not

far advanced, and there I find the prognosis is dependent altogether on three factors. The first is the most important; that is, the judgment of the patient, or the willingness of the patient to remain under treatment. The bulk of my patients as soon as the larynx has improved markedly, as soon as they begin to gain in weight, depart from the sanatorium and return in a few months, of course, very much worse. I will not take cases unless they promise to stay as long as I wish; nevertheless, they do not keep their word and stop treatment. Secondly, the condition of the lungs is a great factor in the prognosis. Lastly, the ability of the patient to take sanatorium treatment is an important factor. There is no question that many of these cases get well—I will change that, no doubt many of these cases get apparently completely healed; whether they are or not, I am sure I do not know.

DR. B. E. SHURLY, Detroit:—There are so many very interesting problems in connection with this subject that it is only possible to bring up a few that are specially related. It seems to me that first of all we must continually bear in mind the fact that practically every case of tubercular laryngitis is associated with a pulmonary lesion, and the question of details of the care and treatment of that case are absolutely questions of the condition of the lung at the same time. There are a great many factors in connection with the lung that decidedly influence the condition in the larynx. We have a very unfortunate state of affairs in this country in this regard, that almost all the sanatorium physicians are deficient in their work in the department of laryngology. You go through the various sanatoria of the country and you will find that the men who are at work in these sanatoria are interested to a very small extent in the special work of laryngology, and therefore these cases are very badly treated. I think we should endeavor to have laryngologists on the staff of every one of these tuberculosis sanatoria, and then we will be able to get better results in the treatment of these cases. In Detroit we have a fine institution, which takes every variety of tuberculosis. We do not stop to ask how much disease they have, whether they are advanced or not. We take them in if there is a vacant bed in the institution; and it seems to me there is a very great demand for that kind of care for these tuberculous individuals, a place where they can receive comfort at least and every special care. I find that these cases of tubercular laryngitis require constant treatment. The cases that we have are given, where there is ulceration, formaldehyde applications twice a day, and our results are better since we have treated those cases in the morning and again in the evening. It is absolutely impossible to treat these patients thoroughly in the office, and therefore these cases for the most part are sanatorium cases. We should try to influence that development, and have these patients under the special care of the department of laryngology in the sanatorium. This is not the state of affairs at the present time.

DR. T. E. CARMODY, Denver:—We have one sanatorium in Denver, the Jewish Consumptives' Relief Society, which takes all cases, although they are considered hopeless when admitted. Many of these improve sufficiently to take care of themselves and to be of service to the community for a number of years. Dr. Freudenthal spoke of control of the cough. It has been my experience, as well as that of Dr. Lockard, that the cautery helps a great deal in many of these cases to control the cough, especially if the inter-arytenoid sulcus is involved. Some of the cases, where the epiglottitis is involved, have been greatly benefited by removal. I

removed one just ten days before leaving home, and the lady came in my office the day before I left with the cough completely relieved. We expect improvement of the general condition after removal of the epiglottis, because of the relief from dysphagia; the patient will take food which it was impossible for him to do before. I reported to this Academy at the fourteenth annual meeting in New York, the case of a man who gained twenty-six pounds in five weeks, although unable to swallow beforehand. I have a case of a man in whom I removed the epiglottis five weeks ago, and four days ago he had gained twenty-two pounds. Before the operation he was unable to swallow solid food without great discomfort. In regard to dyspnea, we find in many cases it is relieved by cauterization and by removal of small masses of granulation tissue; whether it is physical in part is a question. Dr. Freudenthal spoke of the use of cocaine. I do not like the use of cocaine in the larynx because it interferes with the nutrition of the parts, and the reaction afterwards is detrimental. I use alypin entirely, and find the results are very much better. In regard to the point brought up by Dr. Dean, I have been troubled a great deal in the same way. It is very hard to tell what we have in the first place. It comes on a simple laryngitis, and the only way to do is to watch the condition, and you cannot be absolutely certain until you have watched the case several days and note the changes which have taken place.

DR. W. FREUDENTHAL, New York (closing discussion):—I want to apologize to Dr. Beck for not having mentioned his name in connection with the high frequency current; I want to give him full credit for his work. This method is a valuable one and I want you all to try it. It is not the cauterization alone but the sparks carrying ozone, which are effective and disinfectant, and for these reasons this method should be recommended. My applications were not painful because I use 5 per cent cocaine before. The sparks go all over the larynx, and if they strike healthy parts I do not care, because we never know how far ulceration extends into the tissues. In regard to Dr. Dean's remarks, I want to say that very often it is difficult to differentiate between a simple and a tuberculosis lesion. I am in the habit of considering every case of laryngitis in a tuberculous patient, as tuberculous laryngitis. But if such a case comes to you in the beginning, and you do not find any lesions over the lungs, then the diagnosis is very much more difficult. I only want to mention certain facts which I mentioned in a paper I wrote some time ago. If you look into the larynx the whole mucosa of the soft palate is anemic. Laterally, however, in the region of the muscles of the soft palate this region is very much congested. The congestion goes down on both sides of the tonsils to the tip of the epiglottis. There again there is pallor and anemia, and between the two arytenoids we have thickening. But some cases are very hard to differentiate.

I emphasize what Dr. Shurly has said, that in every sanatorium for tuberculosis there ought to be a man who is experienced in laryngeal work. We have such an institution in New York and it works very well. The patients are treated not only once a day, but twice and three times a day if necessary. In regard to Dr. Carmody's cases, I want to say that I agree with him that we want to remove the cough by all means. If the cautery will help, I will be very glad to assist in that, but I am not so sure about the removal of the epiglottis, if you have simply a congestion there. To remove the epiglottis we must have

more symptoms; strong infiltrations that you cannot remove otherwise, etc. I have used alypin and cocaine a great deal, but I use these only when I want to do an operation or the like. I want to repeat again, that it is absolutely ridiculous that we should treat cases in sanatoria that can be treated any where else, where they get open air and good food; that goes a long way. And, it is just as absurd to refuse admission to patients because they have laryngeal tuberculosis.



## TREATMENT OF CICATRICIAL STENOSIS OF THE LARYNX.

EMIL MAYER, M.D.

NEW YORK, N. Y.

Cicatricial stenosis of the larynx may range from a single web to many bands of adhesion producing a more or less complete stenosis, and the disturbances to respiration are in direct accord with the amount of space left by their presence.

The dyspnœa, while practically constant, may be more severe upon exertion or while in an erect posture; in some it may be more severe on lying down, and in these the greatest relief is obtained when the patient is half reclining. Hoarseness to a greater or less degree is always present.

As the treatment of this affection varies with its cause, it becomes first of all necessary to ascertain the etiology of a given case.

Among the causes of cicatricial stenosis of the larynx may be mentioned direct injury to the laryngeal mucous membrane, occasioned by too much violence in the introduction of an instrument, chemical substance or following a galvano-cautery. To this class may be added those cases of cicatricial contraction occasioned by the prolonged wearing of an intubation tube; the effect produced being first the wounding of the part from constant friction at the lower end of the tube, the formation of granulation tissue, resulting in adhesive bands.

Perichondritis of the larynx following typhoid fever may have a resulting cicatricial stenosis. Among the constitutional causes may be mentioned scleroma, lupus, lepra, tuberculosis and syphilis.

Any number of cases are recorded of the swallowing of concentrated lye, some of them producing in addition to the severe pharyngeal lesions, adhesive bands to the epiglottis and interior of the larynx.

The writer has recorded a case of cicatricial stenosis of the larynx produced by gunshot wound.

## TREATMENT.

The amount of disturbance to respiration must be carefully considered at the very outset in mapping out the line of treatment to be followed.

If the dyspnœa is very great, the patient cyanotic and weakened by his constant struggle, a tracheotomy will be primarily indicated. The next step is to restore the lumen of the larynx with the consequent removal of the tracheotomy tube when that end is fully achieved.

To relieve this condition of stenosis is the task which we now set ourselves, and except in the graver forms of disease, we may do so with a degree of confidence of curing the patient ultimately, for we know of no organ in the body which is so tolerant to instrumentation and divulsive methods as the larynx.

Our ingenuity is often taxed to the utmost to find a method applicable to a given case, as will be apparent a little later on, when the methods of treatment are discussed.

A single web of adhesion may be incised by the introduction of a bulb shaped instrument containing a concealed knife, so that by pushing a spring in the handle, it may be cut through, following which the forcible distension of the parts by the introduction of a pair of laryngeal forceps past the obstruction and opening it fully will tear apart the cut edges of the band. The writer treated such a case successfully some years ago in association with his revered colleague, the late Dr. Morris J. Asch.

The method of Sargnon, laryngostomy, consists in splitting the larynx, removing the adhesive bands, introducing a piece of rubber tubing with packing firmly around it; after a tracheotomy has been done (dressings must be changed frequently). These are painful and a long time elapses before the wound may be ultimately closed.

While the results obtained by this procedure are in the main satisfactory, the painfulness of the repeated dressings and the disagreeable formation of secretion about these dressings, render this form of treatment most objectionable, and is only to be made use of when all other means have failed.

The writer has had the most gratifying successes in the treatment of these cases by the use of an intubation tube, and his method consists as follows: A preliminary tracheotomy, if the dyspnœa warrants it, slow dilatation by means of

Schroetter's tubes. These are long tubes of hard rubber, hollow in the center, which may be molded into such shape as to permit of their introduction, and which are of varying width just as are the urethral sounds. These tubes are introduced through the narrow opening and are held in situ by the patient for ten minutes at a time, the largest possible size being used at each sitting; the tube must be lubricated and the larynx made tolerant by the use of a local anesthetic, and they should be introduced three to four times a week.

As soon as the stenosed larynx admits a full sized Schroetter tube, we now proceed to intubate.

In practically every one of these patients an intubation tube is coughed out anywhere from a half hour to two hours or more after the introduction.

In such event the writer has made use of the ingenious device of John Rogers, Jr., of New York City, to whom great credit is due for his valuable suggestion. The full sized hard rubber intubation tube is introduced into the larynx. The tracheotomy wound is thoroughly anesthetized, an applicator is now heated to a white heat and is thrust through the tracheotomy wound to the intubation tube; this is repeated several times, the heated metal makes distinct marks upon the intubation tube and the tube is then extracted, the tracheotomy tube being temporarily replaced.

The markings on the tube indicate a point in direct line with the tracheotomy opening, and at this point a threaded opening is made by the instrument maker, which permits the introduction of a screw piece attachment through the tracheotomy wound, thus effectually preventing auto-extubation. It is not absolutely necessary that the tube with the Rogers attachment should be of hard rubber, as it may be made of metal.

The tube is now worn constantly for four or six weeks, at the end of which time it is removed, and in all probability for all time.

The writer has had occasion to make use of this method a number of times and always with most satisfactory results.

The ordinary intubation apparatus consists of the tube and introducer, which when applied, effectually cuts off all air, a matter of no great moment in cases where rapid intubation is possible. In these cases of stenosis, however, slow intu-

bation becomes necessary, and the writer has devised an apparatus to meet this emergency.

It consists of a hollow handle which, while holding the intubation tube in position by permitting the patient to breathe through the tube and handle, enables us to take as much time as we may desire to introduce the tube.

The addition of the bronchoscope to our armamentarium enables us to treat this class of unfortunates by permitting us to remove obstructions under our direct vision and also to distend the parts. The tubes used are either those of Jackson with illumination at the lower end, those of Killian with the head light or with light in the hand as by the instruments of Kahler or Bruening.

No little credit is due to these colleagues who have by their ingenuity, perseverance, and scientific work given the fruits of their labors so freely to medicine in general and laryngology in particular.

The writer has already recorded the successful use of the bronchoscope as a dilator in a case of scleroma of the trachea, where without its use a tracheotomy would long since have become an absolute necessity.

The limitation of time placed upon me will not permit going in extenso into a detailed description of cases, nor even the more minute description of the treatment of the various forms of stenosis due to constitutional disease; but as the vast majority of cases of laryngeal stenosis are due to syphilis, this subject will receive our attention in the concluding portion of this paper. Until two years ago we should have concluded with the statement that our syphilitic patients must receive the usual mercurial inunctions, injections and internal treatment.

As in other fields of medicine, the remedy of Ehrlich, now known as Salvarsan, has been used in the treatment of cicatricial stenosis of the larynx.

Those of our colleagues who have had early opportunity to procure this remedy have already presented their results, as the recent literature indicates.

Speaking of the treatment of these affections by Salvarsan, Professor Gerber in the *Archiv. f. Laryngologie*, Vol. XXIV, 1910, p. 366, quotes a case of cicatricial stenosis of the larynx in a woman sixty-three years old; she gives no luetic history and states that she began to be short of breath two years



previously, and believed that this was caused by a piece of bone that stuck in her throat: an examination then made showed hard swollen and thick tissues bridging the anterior and posterior portions of the larynx, so that there was a funnel shaped opening, the lower end of which was no larger than a pea. She was much improved under mercurials, iodide and the use of Schroetter's and O'Dwyer's tubes.

In October, 1910, she returned with increased dyspnoea. Wassermann positive, December 15 received her first injection; four days later patient breathed freely and well. The whole cicatricial funnel is gone and the trachea can be seen, and one month later the note is made with a proper exclamation point—normal larynx!

Professor Chiari records his observations in the *Berliner klinische Wochenschrift*, No. XXXV, August, 1911, p. 1587. A total of fifteen cases, seven of them laryngeal; of the latter five were cured, one only in so far that the rapidly advancing necrosis was stopped.

Henke, *Muenchener medizinische Wochenschrift*, No. XXXI, 1911, p. 1670, has an article on Salvarsan in the treatment of laryngeal syphilis. He calls attention to continuous inroads of syphilis, often in spite of most energetic anti-syphilitic treatment, and sounds a note of warning against the use of iodide of potassium because of the danger of producing a laryngeal edema. In addition to the case of Professor Gerber, he cites a second instance of a female, aged 27, who was infected three years previously. She had ulcers on the pharynx and on the tonsil, epiglottis was greatly thickened and red, the right aryepiglottic fold, and false vocal cord all included in a large gummatous ulcer with much infiltration. Narrowing the lumen of the larynx, producing great dyspnoea. Wassermann positive. November 8 she received her first injection of Salvarsan. On the 9th the pain in deglutition and dyspnoea were remarkably improved, the stenosis greatly diminished, and in ten days not a sign of the disease was left. Six months later there was no recurrence.

A number of other writers have presented contributions showing the efficacy of this remedy in affections of the mouth and larynx. The manner of its use and some of the objections to it make another story.

You will permit me to revert for a moment to Professor Gerber's article, from which I have already quoted, to again

quote briefly: "We began these injections really without any expectation, and after four days the dyspnoea of years had disappeared and the cicatricial bands narrowing the larynx to the greatest degree were no longer visible and we had before us a normal glottis. I must admit that this made the impression on myself and my assistants as being simply marvelous."

We are usually self contained, having lived long enough to see remedies that were to do great things utterly fail, hope has been blasted time and again. And, yet when we see some of the marvels that are performed by the administration of this drug, we, too, become amazed and filled with due admiration and pride at the achievement of its originator, Paul Ehrlich, in conferring this inestimable boon upon these doubly unfortunate individuals.

40 East 41st Street.

#### DISCUSSION.

DR. H. B. HITZ, Milwaukee:—I have been greatly interested in this paper because of a very unfortunate case which came into my hands some five years ago. I should like to ask Dr. Mayer if he can suggest the proper care of it now. The condition then was the result of an attack of melancholia in a young woman 28 years of age, who slashed her throat with a razor, the razor having slit up the anterior half of the thyroid. The surgeon who was called in at the time amputated the hanging portions, and one month later I was called in, to see what could be done for the restoration of the voice. The question then was whether to do a low tracheotomy and allow the opening above to close, or whether to place in an intubation tube. The latter alternative was decided upon, and I used a rubber intubation tube that remained in from the 5th of April to the 25th of September, being held by a silver wire loop through the opening in the thyroid cartilage. By the 25th of September the wound in the thyroid had entirely closed, and I determined to remove the tube. I foresaw some difficulty and prepared for it. I had another instrument ready in case of trouble. I then removed the intubation tube. Immediately there was a spasm of the larynx and desperate efforts to breathe. Fortunately the tube was replaced with but little difficulty. To avoid a possible recurrence of this a tracheotomy was done low down, and after the tracheal wound had sufficiently healed the intubation tube was removed and left out. The patient progressed steadily toward recovery with the lower wound open, and from that time on, for possibly six months, dilatation of the wound was kept up with an instrument not unlike that devised by Dr. Mayer, though not quite so well built. In fact, I used a large urethral bougie bent at a greater angle, and later used a flexible stomach bougie, which I cut down to the proper length. Now this patient is wearing today a plugged low tracheotomy tube. She can breathe comfortably when not exercising, but when she exercises she has to open the valve to get sufficient air. Her voice is now good and it is astonishing how well she can use it.

DR. L. W. DEAN, Iowa City:—I want to report a case very briefly; and, in reporting it the technic of what was done will be best explained. This case was reported from the surgical standpoint in the *Annals of Surgery* by Dr. Cottam. Briefly reviewing that report, will say that the patient took a razor, tied the handle of the razor to a stick and cut his throat, severing the larynx just below the epiglottis and cutting through the pharynx to the cervical vertebrae. Fortunately a surgeon was near at the time, and secured the bleeding vessels and saved the patient's life. Two months later Dr. Cottam referred the case to me. At that time there was no opening from the mouth into the larynx; the patient was wearing a tracheotomy tube; the pharyngeal wound was closed and the patient kept alive by nutritive rectal injections. I planned a route for lateral pharyngotomy. The pharynx was opened on a level with the thyroid cartilage. The mucous membrane was sewed to the skin. That was a year and a half ago, and the patient is now a strong working man and is feeding himself through the pharyngeal opening.

After trying unsuccessfully to make an opening from the pharynx into the larynx a laryngotomy was performed. Before doing this I made a number of intubation tubes of varying sizes and shapes, each with a collar at the upper end to prevent the tube slipping down. The dense fibrous tissue separating the larynx from the pharynx was incised. A tube was introduced from the mouth into the opening and the laryngeal wound closed.

The patient wore increasing sizes of tubes for one year. It is now eighteen months since he came under my observation. About five months ago the tube was taken out. The patient has a fine opening into the larynx. By that indirect method a fine view of the cords may be secured. There is no opening from the mouth into the pharynx. The epiglottis was lost before he came under my observation and adhesions prevent the larynx from rising under the base of the tongue during the act of swallowing. I cannot see any way of operating the pharynx and securing an opening without allowing the liquid to run into the larynx. At one time the patient did not return until several months after he should. The opening became large for the tube and it was inspired into the right bronchus. Its removal was very easy by lower bronchoscopy.

DR. M. A. GOLDSTEIN, St. Louis:—Unfortunately the experience of the individual laryngologist is not so great that we can fix any definite axioms of treatment. I recall one case that came under my observation a year ago, a girl of 17 or 18, who during childhood had had an intense laryngeal diphtheria, followed by a most unusual and profuse area of cicatricial tissue. This case had been under treatment for perhaps ten years. She has worn tracheal tubes throughout this period; a laryngoscopy was suggested. Before that, however, tracheotomy was performed, and the entire laryngeal surface exposed. Attempts were made by the Sargnon method and with a modification of Jackson's T-shaped tubes to dilate this stricture or reduce it by pressure. As the result of this pressure an unusual slough was produced; part of the stricture was removed together with a large part of the cartilage. In fact, so much tissue was destroyed by this line of treatment that there was not enough tissue left of the surrounding parts to close over the larynx to make even a small covering for the tubes, so a laryngostomy or plastic extension was a matter of necessity and not of choice. I think the treatment suggested by the essayist would hardly be of sufficient value in such a case because a cicatricial area as extensive as that would hardly be reduced

by pressure and dilatation. I would like to hear from Dr. Mayer, however, whether he has had any experience with pressure and dilatation where a large cicatricial area is concerned.

DR. OTTO J. STEIN, Chicago:—The reference of the essayist to salvarsan in the treatment of syphilitic stenosis of the larynx recalls to mind a case recently in my hands where we assumed the contracture to be due to a syphilitic process, although rather hard to prove. We assumed it for the reason that the patient was an old colored mammy in the clinic, who had this mass of cicatricial tissue in the larynx without any particular history of suffering from throat trouble. She was suffering so severely from dyspnea that it looked as if a tracheotomy was advisable immediately. The opening was extremely small, probably not larger than the size of a veil pinhead. The interior of the larynx was a mass of web-like cicatricial tissue, showing there had been great destruction of soft tissue, with no evidence of vocal cords or any normal mucous membrane; that is to say, in the neighborhood of the cords. Below this opening I thought I could detect a soft granular mass, which added to the obstruction. I was at that time experimenting with cacodylate of sodium, and I tried it immediately in this case, giving subcutaneous injections every other day. I must say that I noticed marked improvement in the dyspnea. I was preparing her for an operation, and did do a laryngotomy, removing the mass of scar tissue in the larynx and incidentally considerable papillomatous tissue, which we could see from above. We continued the cacodylate of sodium for fifteen to twenty injections, and now, after recovering from her operation she has an opening, without any further work of dilation, more than half the diameter of the normal larynx, and no disturbance in breathing. Now this is four or five months since healing. I do not know whether the cacodylate of sodium had much to do with the healing or not, but I would like to ask Dr. Mayer if he has used this remedy in such cases of syphilitic contracture. I am pleased to hear of the influence of salvarsan in old scar tissue in the larynx. I did not know that that was possible. I have a case for it now. I would also like to ask the essayist if he has had any experience with the other solvents like thiosinamin and fibrolysin in conjunction with the dilation method of Schroeder and Mayer's tubes. I imagine the method would be worth while trying.

DR. JOS. BECK, Chicago:—There was one kind of pathological condition mentioned, not cicatricial or scar formation. Fraenkel reported five cases of this kind, and I am fortunate in getting a case of this kind that is, hypertrophied connective tissue causing laryngeal stenosis. I have had a case under observation for two years, and have demonstrated the cure of that case. I will say that after two years, and two laryngostomes, I finally succeeded in the third laryngostomy, but not until I removed this hypertrophied mass—two pieces as large as my thumb. I want to say the Jackson tubes and all the other dilators were used without any results. Laryngostomy and packing with rubber tubing as suggested had been practiced. Then subsequently after we had a free passage, I did as the gentleman suggested; I made a skin flap surrounding the external opening from each side, turned it inwards, sewed it together and then dissected the skin loose and covered that flap. That patient made a splendid recovery and had a voice as good as formerly, when he blocked the tube. Had I used the slow intubation method as suggested by the writer I think I would have treated him without any result. I could not

touch the patient without he gagged, and I had to cocaine him constantly to do the least manipulation.

So far as the use of fibrolysin is concerned it has been absolutely disappointing to me. Some report that there is danger from the use of salvarsan causing an œdema of the larynx and making things worse, but the last reports of a number of cases treated with salvarsan have shown no evidence of œdema from its use; on the contrary, marked relief. I was anxious to hear the writer's own experience with salvarsan. I was sorry the discussion was not continued yesterday. I would like to report two cases of syphilitic infection of the larynx in which I have used salvarsan with gratifying results. I used the injection intravenously. But you must watch your cases. There is not only one but two or three injections, necessary at times, and mercurial treatment, so long as there continues to be a Wasserman positive and shows syphilitic symptoms.

DR. EMIL MAYER, New York (closing discussion):—It is with a great deal of satisfaction that I have to present to you something really new regarding the wonderful effects of salvarsan reported by men whom we know personally, and their statement are to be taken for full value.

I took my time and your time to give the dates as well as the journals wherein this work has appeared, and some of them are as recent as the preceding month.

These authors received the drug early from Ehrlich, long before it was on the market, and their reports are before us now.

I want to answer the various questions as briefly as I can. I want to say as to the first case presented, a most interesting one of attempted suicide, the question asked being what may further be done to assist this patient. I should have been inclined during these many months to change that tube from time to time for one a trifle larger, the tube being put in up to the point of tolerance in the larynx.

There has been much effective work done in this case and we must not lose sight of the fact that there is a psychic element in these patients. They dread the removal of the tracheotomy tube.

I make this as a cardinal rule: If my patient can breathe comfortably through the small opening in the tracheotomy tube for twenty-four hours, the exterior of the tube being corked up during all that time, that tube is going to come out.

Because of the patient's fears and the great advantage of being able to discard a tracheotomy tube that had been worn a long time, I put such patients in bed, give them a sedative, have a competent nurse at hand and a physician within call during the first twenty-four hours.

I have had such a case recently and it required fortitude on my part to resist the patient's pleadings for the first day or two. The tube was not replaced.

Now as to Dr. Dean's case: It seems to me that a great deal can be done with that pharynx. I would try to remove those pharyngeal bands if possible to connect it with the fistulous opening, gradually enlarging it with pharyngeal dilators. No harm and much good may come. The doctor asks whether my patient can swallow. It is remarkable how well this act may be performed after amputation of the epiglottis. I do not say laryngectomy should not be done at all, but I say in my own experience we can do a great deal with patients with dilatation and in many instances prevent laryngectomy.



Replying to Dr. Goldstein as to the amount of stenosis in my cases, I will say that it was complete in every instance; the one a soldier shot in the Cuban embroglio with a smashed thyroid cartilage, another perichondritis of the larynx after typhoid fever, etc.

In answer to Dr. Stein I would have to be sure that the Wassermann test was positive before I would use salvarsan.

Replying to Dr. Beck that he heard no mention of hypertrophic conditions, I would say that I did not mention them nor other classes of stenosis because they were foreign to the subject assigned to me; namely, cicatricial stenosis of the larynx.

## REPORT OF ONE HUNDRED CASES OF SINUS THROMBOSIS.

F. PHINIZY CALHOUN, A.B., M.D.

ATLANTA, GA.

The cases of sinus thrombosis here reported are taken seriatim from the records of the New York Eye and Ear Infirmary, occurring in the services of Doctors Bacon, Dench, Adams, Whiting, Lewis and McKernon, and are analyzed with the hope that they may present some new facts in this important disease.

In the review of these cases, whenever there was any doubt about the diagnosis, or any incompleteness in the record, such cases were discarded, and with this exception this paper does not include any series of selected cases. Hospital statistics are notoriously wrong and misleading, but I can vouch personally for the correctness of a good proportion of this work, for it was my pleasure to observe the first forty-two cases here tabulated, and my good fortune to assist in or to operate on a small proportion of these patients.

It is interesting to note the yearly increase in the number of cases, comparing the one case in 1894 with the twenty-three cases in 1904, no cases in 1895 to the twenty-one cases in 1905, etc. The yearly increase in the number of ear cases at this clinic has not been in proportion to the yearly increase in the number of cases of sinus thrombosis. A better diagnosis must be the only explanation for this fact. A fact of some historic interest is that in 1896 Abbe first excised the internal jugular vein in a case of sinus thrombosis at the Infirmary, while Whiting's patient a few months later was the first to recover.

This series shows a larger proportion in infants and children than is usually reported in text-books. There were 16 patients under 5 years of age, 32 from 5 to 15, 32 from 15 to 30, and 19 from 30 to 66, the oldest. The youngest was an infant three months old; there were many complications and it died after a lingering illness.

The right side was involved fifty-five times, the left forty-five. There were no cases of double sinus thrombosis in which

a clot could be demonstrated. Sinus thrombosis occurred at no special season of the year.

The proportion of acute ear disease causing sinus involvement is rather large, there being forty-eight cases; the remaining fifty-two were in cases associated with chronic discharging ears. Six cases occurred when there was a secondary infection or a recurrence of mastoiditis. Traumatism was the cause indirectly of sinus thrombosis from a rekindling of chronic cases four times. There were also two fatal cases brought about by skin grafts being placed in the cavities of Stacke operations, and one other case induced by an injury to the sinus during a simple mastoid operation.

Smears, often cultures, were made of all aural secretions, and as the majority of the cases were of the chronic type, necessarily the most common type of infection was that diagnosed "mixed"—of no scientific value, although this type could often be followed into the mastoid, the sinus clot and the jugular vein wall itself. Besides this mixed type of bacteria, the streptococci, pneumococci, streptococcus capsulatus, and other organisms of no morphologic characteristics were found. A knowledge of the aural infection is of little practical value, for in this disease one operates for constitutional symptoms or surgical findings.

Examinations were also made of the mastoid pus, pus in or around the involved sinus, the sinus clot and sections of the jugular veins, and these examinations were considered of great importance, because cases in which streptococci were found in the clot, or in which a vein wall showed infection, were considered more serious than if the findings were negative. Again it is of considerable satisfaction to the surgeon to know that he has excised the vein far below the point of bacterial invasion, a condition shown by microscopic mounts; and by way of digression this explains, in a measure, why the excision is preferable to the ligation.

#### SYMPTOMS.

Ordinarily there are two types of infective sinus thrombosis: One with symptoms, one without symptoms; one with chills, remittent temperature, sweats, in addition to the causative factor in the tympanum or mastoid. In this type of sinus thrombosis the diagnosis is readily made. In the other, without symptoms, sinus involvement is only discovered at the time

of the mastoid operation, and it is only an angry, suspicious looking sinus, or a sloughing condition of the external wall, that gives one the first intimation of thrombosis. An exploratory incision in the sinus wall, revealing a clot, makes the diagnosis certain.

Chills or chilly sensations, even in the first class, are not constant, and in this series only occurred in 35 per cent of the cases. Temperature of a remittent type was present in only 37 of the 100 cases; a constantly high temperature occurred fifteen times, and in the remaining cases the temperature was an unimportant factor in the diagnosis of thrombosis, as it was below 103 F. Pain along the course of the internal jugular vein was mentioned as a symptom nine times only, and it meant phlebitis or thrombophlebitis.

"A symptom of diagnostic importance, but one that does not always accompany thrombosis of the sigmoid sinus, is an edematous swelling on the mastoid region, which at times spreads to the temporal region and to the eyelids." (Politzer.) This symptom, commonly known as the Gresinger sign, was met with only three times. It may occur in posterior tip involvement in mastoiditis, and usually indicates extensive destruction. I have seen it of diagnostic value in one case, when there was scarcely any other symptom present. It is due, I believe, to the interrupted circulation of the emissary vein in sinus thrombosis, and in mastoiditis to the rupture of the cortex, with the escape of pus periosteally; in one case it was due to a collection of pus having drained through the mastoid foramen from a large extradural abscess.

Gehardt's symptom, an unequal filling of the external jugular veins on compression and stripping of the vein, is so uncertain a sign that it can hardly be classed as an aid to diagnosis. I have seen it once in a case of thrombosis, in which the internal jugular was involved as far down as the clavicle.

Tenderness high up in the neck behind the angle of the jaw is often caused from glandular involvement, which almost invariably accompanies thrombosis. The glands may become large enough to be palpable, but they are usually found deep, surrounding the internal jugular vein when the excision is made.

An optic neuritis, variously estimated as occurring in cases of sinus thrombosis, in from 8 to 50 per cent of cases, occurred

in 35 per cent of those examined. The neuritis was usually double; it began on the affected side, and it varied in extent from a slight haziness of the disc margin to a severe papillitis. Nystagmus occurred three times, but it was not regarded as a symptom of thrombosis, but of labyrinthine supuration or irritation.

There is one case of cavernus sinus thrombosis in which the usual proptosis and marked papillitis was present, beginning in the eye of the affected side, then extending to the other side a few days later.

In most of the cases of thrombosis giving eye symptoms the thrombus was found deep in or near the bulb, with a possible extension along the inferior petrosal or smaller veins to the base of the brain. While optic neuritis has never been regarded as an unfavorable symptom in thrombosis, in the 60 eyes here examined 14 of the 21 cases with neuritis terminated fatally. It would then seem, while the prognosis of a case of sinus thrombosis is always grave, with the presence of an optic neuritis the condition is still more serious.

Occasionally an acute or post-operative edematous swelling of the eyelids is present, and is regarded by McEwen as a circulatory disturbance of the accessory small sinuses.

The meningeal type of thrombosis, being one of the three types, as classified by McEwen, viz.: meningeal, abdominal and pulmonary, here occurred rather frequently. The meninges may be attacked independently of the thrombus, or the meningeal involvement may be an extension of the thrombus itself. Headache, the chief symptom, was so prominent that it was customary to ask the patient of its presence, along with those of chills, fever and sweats. The pulmonary type I found quite as rare as the abdominal type. Severe abdominal pain occurred only twice and peritonitis developed once. They may be regarded seriously.

Cases of sinus thrombosis, without symptoms, the second classification, brings to the attention cases constantly seen in large clinics, in which an operation is performed for mastoiditis only a short while after the patient's admission to the hospital, and the thrombosis is then accidentally discovered. A perisinus abscess, causing a sloughing external wall, leaves little doubt as to the diagnosis. But when the sinus wall is intact, with or without granulation, discolored, tense or collapsed, it makes some operators uncertain whether the sinus should



be explored then or the patient returned to his bed and the development of more positive symptoms awaited. A thorough knowledge of the patient's history, his *status præsens*, his facial expression, the condition of the mastoid, should influence the operator more with the idea of exploring than the appearance or "feel" of a sinus. It is true that an exploratory opening into the sinus rarely causes any untoward result, for in an analysis of 400 mastoid operations the sinus was accidentally or intentionally opened 30 times without symptoms.

Blood counts have been of doubtful value in the establishment of a diagnosis. In this series many cases gave a marked leucocytosis with a proportionate polynuclear increase; others did not, and the results were quite confusing.

#### THE OPERATION.

While no effort will be made to describe the differences in technic employed by the various surgeons, some phases giving the best results, as I saw them, may be mentioned with advantage.

The sinus was always approached through the mastoid wound and exposed after the operation on the mastoid had been completed. As time was often a serious factor in these cases, and as shock was a usual accompaniment, it was the operator's desire to work as rapidly as possible, even at times overlooking some of the niceties in technic. Frequently a radical operation was delayed to some subsequent time in order to clean out the mastoid and approach the sinus as easily as possible.

When the sinus was exposed and the clot approximated, further exposure was made toward the torcular end and as far down toward the bulb as possible. The Mathieu rongeur forceps was used in the thickest cortex, while the small forceps of Jansen or Pyle was applicable to the thin covering of the inner plate; when adhesions existed extreme care was used, lest the sinus wall should be torn. When the spoon curette and chisel were used more accidents occurred and sinuses were injured than with the forceps.

After free exposure was made the sinus and mastoid cavity were irrigated with saline solution, then the wound flooded with alcohol. This was done to free the wound from detritus and to sterilize the field for the more serious procedure of exploring the sinus.

The primary sinus incision depends greatly on the approximate location of the thrombus or the external pathologic condition of the sinus wall.

The neck is immediately prepared for the jugular operation, and after a pillow is placed beneath the neck or under the shoulders, the neck is placed on the stretch and the sternomastoid muscle, a prominent guide for the initial skin incision, is plainly seen or felt. It is best not to continue the neck incision upward to unite with that of the mastoid wound; besides being useless, there is danger from infection, especially if the neck is closed. All possible haste is exercised in the initial ligation at the point where the omohyoid muscle crosses, or lower if necessary, and then the dissection is carried up as far as possible and the vein ligated, care being taken not to injure important structures high up and deep in the neck. Twenty minutes is an average time for this part of the operation.

Most surgeons leave the neck wounds open and let them heal by granulations and depend on strappings for wound approximation. I prefer partial closure, with a large cigarette drain at the lower angle. I have never seen harm come from such measures, and do not know of a contraindication, other than a pleural injury just above the clavicle, or the patient in shock. Healing takes place in from a week to ten days, and the scar is much less. If an infection occurs the neck is easily opened.

According to the records, there were 26 closures; 15 were healed, 11 were opened. I do not know that many wounds which required opening later were not treated in the proper way; for instance, some were entirely closed without drainage; one was filled with balsam, for what reason I do not know, and the neck and mastoid wounds were made continuous in others, causing infection in the neck.

In one of my cases the thrombosis extended nearly to the clavicle. The vein wall was infected, as was its fibrous sheath, proven later by microscopic slides. Glands were removed along the course of the vessel, yet the wound was closed, with the exception of a large cigarette drain in the inferior wound, and healing took place in seven days.

After the neck has received its attention, then the mastoid wound must again be inspected. The wall of the sinus should be trimmed and the lumen cleared of clots or detritus. A

small flexible-handle ring curette can be introduced into the sinus with impunity and the upper bulb reached, and what flow returns comes from the accessory sinuses leading off of or near the bulb.

The ends of the excised sinus are plugged with iodoform gauze, best by having the lumen obliterated with the plug placed between the overhanging bone and the sinus wall and the usual mastoid and neck dressing made.

On the third or fourth day the first dressing is done, leaving the sinus plugs in place until the next dressing, two days later. Then the wounds are dressed at regular intervals, according to their condition.

When the sinus is alone curetted, as was formerly done, the results are not so uniformly good. There is danger of emboli being set free into the circulation, with the formation of metastatic foci of infection.

When the curettment is done one day, and later the jugular excised, after waiting for symptoms, here too the results are not so uniformly good. Of 6 curettments, then subsequent jugular excision, four patients died and one recovered; there was no return flow, indicating that the true clot was well in the bulb and had not been reached. The other patient developed metastatic abscesses the day after the curettment.

Such a procedure is entirely unsurgical, and the patient is not given the best chance of recovery; on the contrary, his entire body is in jeopardy through infection.

Pneumonia as a post-operative complication is always serious, especially when brought about by allowing emboli from the original seat of trouble to be carried into the general venous system.

Patients who are curetted usually have this complication, and in eight out of twenty-five cases in which the sinus was curetted pneumonia developed promptly; all cases terminated fatally.

When there is a satisfactory return flow from the bulbar end of the sinus after it has been explored, it by no means indicates the absence of a thrombus. The thrombus may be below the entrance of the inferior petrosal, or at the condylar vein, or, too, the clot may be a parietal or an annular one. I once saw pressure made high up in the neck over the course of the internal jugular vein, then the sinus and the bulb curetted, forcing out a clot that was of sufficient size to plug the vessel. The direction of the blood current was diverted by the neck pressure,

so that backward through the sinus was its only avenue of escape. The surgeon was working against great odds, and the patient worn by it. It is not, however, a practice that should be commended.

At the time of operation a demonstration of a clot in the sinus is the one thing most sought after, for without this demonstration one is not morally sure of the diagnosis.

A classification of the location of the thrombus as found in these 100 cases might be of interest. Since the majority occurred at or near the knee, the anatomical relationship at this point to the antrum, and on account of the many minute vessels emptying at this location, would naturally lead us to explore this place first. According to the accompanying diagram (Fig. 1) the classification is as follows:

Torcular to bulb, 1; short distance behind knee and bulb, 5; horizontal and vertical limbs and bulb, 23; horizontal and vertical limbs and emissary vein, 2; knee alone, 2; vertical limb with the emissary vein, 2; parietal clot near the bulb, 1; sinus and upper jugular, 5; bulb (1 mural, 1 parietal), 7; bulb and upper jugular, 1; entire jugular into the thorax, 1; undemonstrable, 7.

#### RESULTS.

Of the 100 cases, life was saved 59 times, or there was a mortality of 41 per cent. Four of the 41 patients dying were in a moribund condition when brought into the hospital and died a few hours afterward. There were 24 cases in which curettment was alone practiced, with 7 deaths, all from pneumonia. There were 72 cases in which a curettment and jugular excision were done; 42 recovered and 30 died. In 6 of this number a curettment was done one day and the jugular excised from one to three days subsequently. Four died and 2 recovered of this number.

#### CONCLUSION.

The two operations, that is, the curettment alone, or the excision with the curettment, in percentage, shows practically the same mortality. The number of cases here represented is small, therefore such statistics are practically valueless. Therefore, one must judge from his own experience, use his surgical judgment and at the same time exercise common sense in determining the best procedure. Primary curettment seems to me absolutely unsurgical, and the fatal results from pneumonia and

other dangerous complications from metastasis would warrant advocating and doing jugular excision.

833 Chandler Building.

#### DISCUSSION.

DR. S. KOPETSKY, New York:—We are particularly fortunate in having the report of a man who has watched a number of operators.

There is little to add, except by way of emphasizing the question of diagnosis. There is one point of value not mentioned, however. I refer to the use of blood culture. Although not as strongly valuable as its originators intended, a streptococcemia—ruling out all other causes of its presence—is of distant value in giving you a sign for operation. In the absence of clinical signs of thrombosis, a streptococcemia in our opinion is of no value.

Of another point mention might be made; that is the treatment after operation. I think a great deal depends, in securing recovery, upon how a case is managed after operation. No great amount of technical skill is required to eviscerate the thrombos, but the handling of the patient afterwards is not an easy matter, and requires a great deal of judgment and the use of certain drugs in definite quantities. For instance, you have a patient with a thrombosis, and a resultant septicemia. That septicemia is to be combatted. We have found that large doses of urotropin is one of the best means we have for that purpose. We also find that the injection of the washed white blood corpuscles—the so-called Hiss leucocytic extract—has proven of great value.

Regarding the second paper, I wish to report a case very briefly, in which the presence of a cavernous sinus thrombosis was suspected, but I do not know whether or not it was present.

Upon the patient a Killian frontal sinus operation was performed, and immediately afterwards oedema occurred around the eye-ball. The temperature rose to 107 and a positive blood culture of streptococcus was obtained.

Two hundred and fifty grains of urotropin a day were administered, and continued until the patient developed a hemorrhagic nephritis. The patient recovered.

I cite this only to accentuate the importance of considering the after-treatment of these cases.

DR. J. A. STUCKY, Lexington, Ky.:—I wish to ask Dr. Calhoun how often he had a blood count made. I think we make a mistake in making occasional blood counts. If the blood count is made every twelve hours, or at the most every twenty-four hours, we will get a line on the patient that we will not get any other way. I am in accord with what Dr. Kopetsky has said. The operative technic is familiar to all of us, but I rise to emphasize the value of urotropin in large doses. I am glad to hear Dr. Kopetsky giving 100 or 200 grains a day. Give it for its effect, and not according to the dose. I very often begin with twenty or thirty grains. If the patient cannot swallow, I give it by rectum—proctoclysis—but I feel sure in this remedy we have something very valuable to combat sepsis, which we so much dread in these otological cases.

DR. S. IGLAUER, Cincinnati:—There is one remedy in the after-treatment which has not been mentioned, and that is antistreptococcic serum. I



think that almost every case of sinus thrombosis is due to the strep-



think that almost every case of sinus thrombosis is due to the streptococcus, and I have at the present time a case under observation in which the ligation of the jugular and cleaning out the sinus—although the sinus was not completely involved—was not followed by a cessation of temperature, until the serum had been repeatedly administered. I believe in these cases we have a generalized infection either in the blood or secondary foci in some of the internal organs, and therefore after tying off the vein there is a residual infection which we must combat. In the case mentioned urotropin was also used, but in insufficient dosage, but we resorted to antistreptococcic serum for three or four days, and then the temperature suddenly came down (crisis) as it does in diphtheria. I believe in this particular case the serum probably saved the patient's life.

Just a word about the blood culture. My experience has been rather limited, but I recall a case I had last winter where I was rather sure the man had a sinus thrombosis, but I waited for the blood culture. The culture was slow in developing. I finally got tired waiting for the culture to develop and operated, three days after the culture was taken. The patient meanwhile had developed a meningitis, and about six hours after the operation I got a report on the blood culture, which was positive. So, as Dr. Calhoun has said, in cases of doubt you should not wait for blood cultures in order to determine your action. I believe that repeated examination will usually reveal streptococcus. As regards blood count, I think it is of value not only in determining whether you should operate, but if you have a high leukocytosis, continuing after operation it renders the progress more unfavorable as to the ultimate outcome.

DR. E. C. ELLETT, Memphis, Tenn.:—In regard to the cases of lateral sinus thrombosis, I was comparing notes with Dr. Calhoun, and it seems that these complications of middle ear suppuration are much less frequent with us than they are around New York or, at any rate, further north. I have never recognized a case of sinus thrombosis, with two possible exceptions, and I think I was mistaken then, because the patients got well without treatment in both cases. So I think my diagnosis was erroneous. And if I had not recognized it the diagnosis would probably have been thrust upon me in the shape of an undertaker's certificate. But I guess there is no one practicing in New York for several years but who has seen a case of sinus thrombosis. Our cases run a very much milder course so far as my observation goes. One of these alleged cases of sinus thrombosis had all of the classical symptoms; he had the middle ear suppuration, slight mastoid tenderness, irregular chills, leukocytosis and he had the streptococcus in the discharge from his ear. I told the people that unless they would consent to an operation I would not be responsible for the man's life. The next day I learned that he had gone to work. The next case I had, I kept my diagnosis to myself, and this patient, a little girl, recovered without any treatment except the usual treatment for acute suppuration of the middle ear. I was glad to hear Dr. Calhoun make the statement he did about the discharge from the ear. It certainly does not seem to cut any figure. I have seen cases with streptococci in the discharge get well without a symptom, and I have seen cases of staphylococcus infection go on to the most severe mastoid involvement. I remember noticing two adjoining articles in the *Archives of Otology* several years ago; one was by Dr. Wendell Phillips, in which he thought the character of the organism

was of considerable importance, and the next article was by Prof. Bezold, who said the character of the organism was of no importance.

In regard to the paper on cavernous sinus thrombosis, I have had four cases, three published in the paper to which Dr. Martin referred, and one which was reported by my assistant in the *Archives of Ophthalmology*. Two of these cases originated in furunculosis of the ala nasi, one arose from the frontal sinus and the other from dental caries. They all resulted in death.

DR. F. P. CALHOUN, Atlanta, Ga. (closing discussion):—In reply to Dr. Stucky's question, in cases where there was doubt as to a diagnosis, blood counts were made every twelve to fourteen hours, and I did not believe they were of any particular value, as the results were so conflicting.

## THROMBOSIS OF THE CAVERNOUS SINUS, WITH REPORT OF CASE.

H. H. MARTIN, M.D.

SAVANNAH, GA.

The predisposing causes of thrombosis of the brain sinuses are their size and shape, the inflexibility of their walls, the trabeculæ occasionally found, especially in the basal sinuses, the fact that they are never quite emptied during respiration, and the direction and variability of the blood current which enters them. In point of fact a careful study of the anatomy and physiology of the brain sinuses, especially the cavernous, leads one to wonder that this condition is not of more frequent occurrence.

There are two varieties of sinus thrombosis, marasmic and septic. The former is not met with so frequently as the latter and almost always occurs in the longitudinal sinuses, rarely in the basal. It occurs also most commonly at the two extremes of life, its immediate or exciting causes being any of the conditions which bring about dilatation of the right heart, exhausting diseases, such as diarrhœa and marasmic conditions in general.

Septic thrombosis, on the other hand, is caused exclusively by the invasion of pathogenic organisms and may occur at any age. The majority of cases reported, however, have been individuals over thirty and under fifty. The origin is purely local, as a rule, and the infection may be propagated by direct continuity of tissue, or the elements of infection may be carried by the circulation. Its location is primarily in one of the basal sinuses and being always secondary to some external infective lesion, it occurs at a point very near to the primary source of infection.

The sinus most commonly affected is the sigmoid, and its cause is usually middle ear disease, though traumatism, such as compound fracture of the skull, are often responsible for this condition.

Cushing reports a case of unilateral nonseptic thrombosis of the cavernous sinus from basal fracture with recovery. Septic thrombosis of the cavernous sinus may result from lesions which are of daily occurrence and which in themselves are quite insig-



nificant, as any infective lesion in the area drained by the ophthalmic vein or any of its branches may result in this very grave disorder. Among the most frequent primary causes of septic thrombosis of the cavernous sinus, are carbuncles, erysipelas, infective cellulitis, nasal ulceration, periostitis from dental caries, tonsillitis, retropharyngeal abscess, pustules in the face, nostrils, eyelids, etc., purulent affections of the accessory sinuses and infected wounds.

The case which I have to report was a septic thrombosis of the left cavernous sinus following what was called a "rising in the nose," which, as near as I could determine, was a furuncle, occurring in the cartilaginous tissues of the left nostril and emphasizes the necessity for care and cleanliness in the treatment of any of the lesions enumerated above.

E. C. Ellett in reporting three cases of infective thrombosis of the cavernous sinus has made an exhaustive review of the literature on that subject and the following paragraphs are abstracted from Ellett's paper:

"The literature on this subject is not abundant by any means. Dwight and Germain append an extensive bibliography to their report of four cases and were able to find 178 cases, with their four, making 182. The importance of the condition lies in its great mortality, only 14 of these 182 cases recovering. In septic cases the prognosis is always bad. Since this collection of cases others have been reported by Day, Lodge and Finlay. Finlay remarks that 'One can scarcely seriously contemplate reaching the local lesion through the orbit by means of a craniotomy.'

"By far the most lucid and satisfactory exposition of the subject that I have seen is in McEwen's 'Pyogenic Diseases of the Brain and Spinal Cord,' and what can be said on the subject in general is excellently said by him.

"The symptoms naturally divide themselves into (1) the local and (2) the general. The general symptoms are those of sepsis under any and all circumstances. The local symptoms may, following McEwen's scheme, be divided into (a) those due to venous obstruction and (b) those due to pressure on the nerves. Venous obstruction causes oedema and chemosis of the affected area, viz., the orbit, the skin of the nose, forehead, cheek and sometimes fauces, pharynx and neck. Necrosis of the skin may ultimately result also. The exophthalmos, which is a prominent symptom, is due to engorgement of the tissues of the orbit.

"Pressure on the nerves causes characteristic symptoms. The

nerves involved are the second, third, fourth, sixth and the ophthalmic division of the fifth. The visual disturbances are usually very marked, due to pressure on the optic nerve and œdema of the retina, while the motor disturbances are most pronounced in the parts supplied by the third. The ophthalmoscope shows dilated and tortuous retinal veins and œdema of the retina. The disturbances due to pressure on the fifth are variable.

"A very important and characteristic symptom arises from the fact that while the trouble is unilateral at first, the thrombosis soon spreads to the opposite sinus and obstruction and other symptoms appear in the area drained by it.

"The œdema of the lids of the second eye beginning at the inner canthus and not due to direct extension (the parts at the roots of the nose lying between the eyes being normal) is very characteristic.

"The diagnosis must be made from tenonitis, orbital cellulitis and facial erysipelas. If attention is once drawn to the condition under consideration the diagnosis is not difficult.

"The prognosis in septic cases is, I believe, uniformly bad. In one of the series reported by Dwight and Germain, operation was performed and they think the results are promising.

"Hartley demonstrated its feasibility in Knapp's well-known case, but the question is probably one for the general surgeon. Since prognosis otherwise is absolutely bad, it seems to me proper that operation should be tried. Other than this the treatment is supporting and symptomatic.

"Dwight and Germain stand alone in their advocacy of operation, but it is to be hoped that their encouraging results will lead others to give the matter a trial. There is nothing to lose."

I first saw the case I have to report, with Dr. J. C. Harris of Collins, Ga., about noon February 22, 1911. The clinical history is as follows: Patient had had what he called a "rising in the nose," nine days previously (February 13). This pustule or furuncle, whatever it was, ruptured spontaneously February 15.

Pain about the nose was complained of continuously, swelling about the inner canthus of the left eye was noticed February 18, this rapidly increased, and on February 19 there was distinct exophthalmos, dilated pupil, conjunctival chemosis with paralysis of external ocular muscles, great œdema of forehead, cheek and orbit, superficial veins distended and tortuous. This condition continued to grow worse until February 21, when the same symptoms began to manifest themselves on the right side, and as

Ellett puts it, this was unquestionably an extension of the thrombus to the right cavernous sinus and not an extension of œdema across the forehead, as the tissues at the root of the nose remained comparatively normal, while swelling began at the inner canthus of the right eye and pursued a course exactly similar to that in the left eye. Temperature, pulse, etc., being typically septic from the beginning.

When I saw the patient on February 22 there was no trace of the primary lesion, but the conditions above described were much in evidence. There was complete oculo-motor paralysis on each side, a very tense exophthalmos, a blue œdema of the face, forehead and neck, chemosis of the conjunctivæ with dilated and tortuous veins in and under the skin.

There were no fluctuating areas and the external condition remains as a venous stasis from beginning to the end, without visible pus formation, although Dr. Harris informs me that there was a discharge of pus from the nose after death and that the eyeballs began to recede immediately after death. The exophthalmos disappearing entirely within a few hours and that within 24 hours the appearance and location of the eyeballs were normal for the cadaver. This has not been noted in other cases so far as I know. The patient complained of pain in the head continuously, worse in the occipital region but was conscious or could be aroused to consciousness up to within a few hours of death. He was totally blind but the fundi showed no changes other than distention and tortuosity of the veins.

He died on the 23d, just ten days after the appearance of the pustule or furuncle in the nose.

The conclusions to be drawn from this case are that without surgical interference, septic thrombosis of the cavernous sinus is surely fatal. That the inaccessibility of the parts affected and the many difficulties to be encountered in surgical intervention, should not deter us if the condition is recognized reasonably early (before the thrombus has extended to the opposite sinus), that the diagnosis is not difficult and that we should at all times be on our guard in any septic conditions, however simple, occurring in the area drained by the cavernous sinus, and that in operating we have nothing to lose and a great deal to learn even if we accomplish nothing else.

So very few recorded attempts to open and drain the cavernous sinus have been made that our literature on that subject is quite barren. Two routes are open to us, the temporal and the orbital.

The latter I believe to be the most feasible, even though it entails the loss of the eye. In this case I made no attempt at surgical interference because the thrombosis had already extended to the opposite sinus, and the patient was in his own primitive log house in the piney woods of Georgia, consisting of a single room, which was kitchen, dining-room and bedroom combined, with no facilities at hand for even the crudest surgical technique. Since writing this report, however, I have seen a second case, in which operation by the orbital route was attempted with no benefit to the patient and very little to myself. This case I will report at some future time, together with a report of some work done on the cadaver.

## THE CORRECTION OF NASAL DEFORMITIES BY MECHANICAL MEANS AND BY THE TRANS- PLANTATION OF BONE.

WILLIAM WESLEY CARTER, A.M., M.D.

NEW YORK, N. Y.

"An inch off the end of a man's nose makes a lot of difference." This axiom embodies the mainspring of cosmetic rhinological surgery, and sounds the keynote to the situation, namely, that the appearance of the individual is to a large extent dependent upon a symmetrical nose and one bearing a correct proportion to its facial environment. Any departure from this is a blemish, but it is only when there is a pronounced deformity that the case comes under our present consideration.

It is necessary for me to review briefly some of the work that I have already published, and with which, no doubt, many of you are familiar, in order that I may make clear my position in regard to the correction of nasal deformities, namely, that in all cases correction should be attempted either *by the readjustment of the displaced parts, or when there is a deficiency in construction material, that this should be supplied from some other part of the patient's body.*

This review is necessary also in order that we may make a clear differentiation between the cases adapted to each of these methods.

It is my purpose in this paper to describe these two methods of procedure, report the clinical results obtained, and record the conclusion I have drawn from this experience.

Though it would please me greatly to review the excellent work done by those who have labored in this field of surgery, the time allotted me does not permit of this digression.

Nasal deformities from a broad surgical point of view may be divided into: (1) Those without loss of bony tissue. (2) Those in which a portion or all of the bony framework of the nose has been destroyed either by disease or by traumatism. In the first class of cases which are usually traumatic, we have all of the bone originally in the nose, and in addition, if the case is an old one, the callus formed about the displaced fragments. In such cases and in recent fractures of the nose I have found



the bridge-splint operation most effective. For this reason, and because of an enlarged experience gained by the use of this method during the past five years, I feel that I may be pardoned for again describing an operation which, no doubt, is familiar to many of you.

The bridge-splint consists of a fenestrated steel bridge, the wings of which are connected by a hinge. The distance to which



Fig. 1.

these wings may be separated is regulated by a thumb-screw. The second part of the instrument consists of two hard rubber splints perforated by several small holes. The instrument depends for its efficiency upon the fact that when properly placed in position, it exerts force along the lines that would tend to construct a perfectly symmetrical nose. In other words, it duplicates as nearly as possible the forces employed by Nature in the development of the flattened nose of the infant into the more

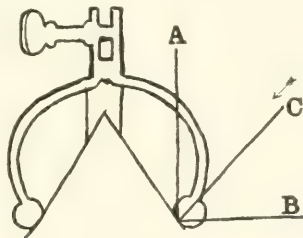


Fig. 2.

shapely organ of the adult. When applied in a case of depressed nasal bridge, its influence directly opposes the forces that produced this deformity.

#### APPLICATION OF THE INSTRUMENT.

Let us assume that we have a recent fracture, or, in the case of an old deformity, that the bony structure of the nose has been thoroughly mobilized by means of the author's special chisel

and chisel-forceps in the manner described in my previous presentation of this subject.\* A piece of No. 14 silk is passed through one of the holes in the hard rubber splint and knotted, or preferably, a splint molded from gutta percha to suit the case is used. The other end of the suture is threaded into a medium-sized curved needle; this is passed from within the nose through the cartilaginous dorsum just below its attachment to the nasal bones. This operation is repeated on the opposite side and the splints are adjusted to the roof of the nose. The bridge is then applied and the wings, the edges of which have been previously padded with gauze, are adjusted by means of the thumb-screw so as to give the proper support to the base of the nasal triangle. The dorsum of the nose is then pulled up into its proper position by means of the sutures and the latter



Fig. 3.

are tied together over the hinge of the bridge. The instrument is left in position for about two weeks. If the bridge is anchored to the forehead by means of adhesive straps, the patient need not be confined to bed after the second day.

I have operated upon about fifty patients by this method. This series includes recent fractures, old depressed, irregular and lateral deformities. There were only two failures, and these occurred early in my experience before I fully realized the limitations of the operation, namely, that it is not applicable when there is insufficient bony framework to support the nose after the removal of the bridge. In several instances it was necessary to do the submucous operation before correcting the external deformity; but in the majority of the cases the intranasal deformity was corrected by the bridge-splint operation. This is one of the strongest arguments in favor of the latter procedure. In many cases I found that the septum was so short

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that it did not permit of the bridge being raised. In these instances in order to lengthen it, I incised the septum from the floor of one nostril diagonally through to the roof of the other. This allowed the upper segment to slide by the lower when the



Fig. 4.



Fig. 5.

bridge was raised without leaving a perforation. My experience during the past five years, and the present condition of the patients operated upon, enables me to give this method of treating this class of nasal deformities my hearty endorsement.

The following observations, drawn from this experience, may be worthy of record:

- (1) Great care should be exercised in the selection of cases.

No case should be attempted by this method alone, where there is not a sufficient amount of bony framework to support the nose after the removal of the bridge. In certain cases, however, where it is necessary to transplant bone, the bridge-splint is a valuable adjunct. In these cases it does not seem to complicate the operation.

(2) The bony framework must be thoroughly mobilized, and when the septum is too short, it must be lengthened by the incision previously described.

(3) The wings of the bridge must be well padded with gauze and the skin upon which these rest must be frequently inspected and bathed with alcohol, lest pressure necrosis occur at these points.

(4) The intranasal splints must be made to conform to the roof of the nose. It is best to mold these out of gutta-percha to suit each case. (Personally I never use the splints that come with the instrument.)

(5) The liberal use of vaseline in the nose following the operation greatly relieves the tumefaction of the tissues and lessens the liability to infection.

(6) Casts both before and after the operation should be made.

#### NASAL DEFORMITIES ATTENDED BY LOSS OF BONE.

The treatment of nasal deformities where there has been a loss of bony framework is an entirely different problem; the use of the bridge-splint being inadequate, because there is nothing to retain the shape of the nose after the removal of the bridge. For these cases little has hitherto been done, and no satisfactory expedient for their relief has been adopted. They are unsuitable for paraffin on account of the large amount of fibrous tissue which is always present, and then, too, there is no solid foundation upon which the latter can rest. Paraffin, even though it be skillfully injected, may spread into undesirable locations; or if properly placed it may later shift its position. At best it is a foreign body, and as such is subject to the uncertainties that surround such substances when held in the living tissues.

The essential element lacking in these cases is bone, and this must be supplied.

The efforts of those who have experimented in this field of surgery, have been confined chiefly to supplying defects in the long bones and those of the skull. It has been demonstrated by

these men that the autoplasmic operation, i. e., the transference of bone from one part of the body to another, gives the quickest and best results.

(2) That homoplastic transplantation, i. e., from one animal to another of the same species, is frequently successful.

(3) That heteroplastic transplantation, i. e., from one animal to another of a different species, is unsuccessful.

Most of these observers believe that it is necessary to include the periosteum with the bone graft. With this view I do not concur for the following reasons: (1) Soft tissues (which would

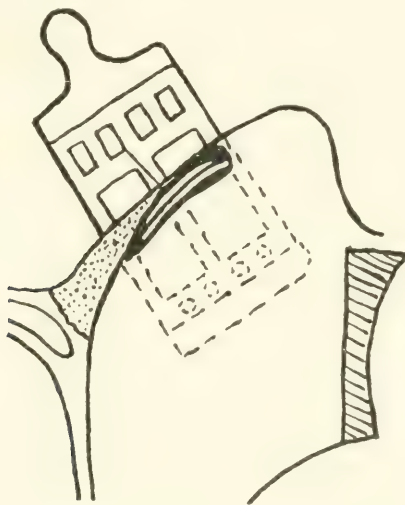


Fig. 6.

include the periosteum) are successfully transplanted with much more difficulty than bone.

(2) When the bone is introduced into the nose we desire only that it shall be nourished, and that it shall remain in situ. We do not desire to grow bone, hence we can dispense with the osteo-genetic layer of the periosteum.

(3) The bone when deprived of its periosteum comes in more intimate contact with the soft tissues which surround it in its new location and from which is quickly formed an envelope of connective tissue, which nourishes it.

In my work in this field I have confined myself to the autoplasmic operation, the rib having been selected for transplantation for the following reasons: The ninth rib, at about its middle, is thinly covered by muscle, a segment at this point can be easily shelled out of its periosteum. The operation causes the



patient little discomfort and the rib is promptly regenerated from the periosteum.

(2) The rib is especially adapted for transplantation into the nose because of its shape and structure, the slight curve being an advantage. The fact that the rib is abundantly supplied with minute nutrient foramina favors its nutrition when introduced into the tissues of the nose.

#### DESCRIPTION OF BONE TRANSPLANTATION.

The following is a general description of the operation which I have performed nine times. It has been modified in some instances to meet special requirements, but these modifications will be referred to later in the specific report of these cases:

The skin over the nose and over the right side of the chest corresponding to the ninth rib is prepared for an aseptic operation. A curvilinear incision (convexity downward) about three-fourths of an inch long is made down to the bone over the naso-frontal process. Through this incision the skin and subcutaneous tissues over the dorsum and sides of the nose are elevated with a long thin two-edged knife, curved on the flat. Above this incision the periosteum over the naso-frontal process is elevated for about a quarter of an inch. This wound is then covered with sterile gauze. The ninth rib, at about its middle, is then exposed, and a portion two inches long is shelled out of its periosteum and removed. I then split this section of rib in its transverse diameter. All of the medullary tissue is then carefully scraped from the outer half, and the thin strip of compact bone is shaped to suit the deformity. If the medullary tissue is not removed from the transplanted bone, it has been found that it causes irritation and an aseptic fever, and the graft is more apt to slough out. It is desirable to transfer the bone to the nose as quickly as possible and that, too, without placing it in any solution. The strip of bone is inserted into the wound in the nose previously made for its reception, the lower end reaching nearly to the tip of the nose, and the upper being carefully anchored under the periosteum over the naso-frontal process. The latter procedure is greatly facilitated by turning up the curved flap made at the time of the original incision. The wound is closed with horse hair sutures and dressed with sterile gauze. If the case is progressing satisfactorily, the dressing is not disturbed for a week.

Owing to the courtesy and hearty coöperation of Dr. Harmon

Smith, I was enabled to develop the technique of this operation in his clinic at the Manhattan Eye, Ear and Throat Hospital. Several of the following cases are from this clinic, the first three of these having been previously reported, are mentioned again for the purpose of showing their present condition.



Fig. 7.



Fig. 8.

Case 1. This patient was a little girl, aged six, who, when two years old fell on her nose, fracturing it. The nose retained its infantile type, developing broad and flat and scarcely protruding beyond the level of the face. No nasal bones could be demonstrated. After the operation, which was performed on June 21, 1910, the profile was almost perfect and has remained so up to the present time.

Case 2. A woman, aged 25, who fell on her nose when she was seven years old, the injury being followed by a septal abscess. In this case there was no history of syphilis, and the woman says that she always enjoyed the best of health. The deformity was marked, and was of the flattened, concave variety. Operation was performed on June 25, 1910. In this instance the concavity was so great that two layers of bone grafts had to be superimposed. The bridge is completely reconstructed, and has remained so. The bone is firmly imbedded, and the X-ray plate seems to show that bony union has occurred between the two implanted fragments.

Case 3. A railroad man, aged 47. This patient claimed to have been perfectly healthy previous to a railroad accident, in which his nose was injured, the injury being followed by erysipelas, when much bony tissue sloughed out. Since my first report of this case I have been informed by the physician who attended him at the time, that the injury to his nose was trivial, and that his deformity was due to syphilis, for which he received treatment. The bridge was badly depressed and flattened, and a large scar bound the skin to the subjacent tissue. The septum was almost completely destroyed. The case presented a very unfavorable outlook for correction by any method of treatment. The operation was done on October 20, 1910. The normal contour of the nose was immediately restored. The grafted bone acted as a rafter, and, being firmly supported by the naso-frontal process, which served as a fulcrum, it continued to exert a gradual traction on the soft tissues of the nose, which, having been unsupported, had subsided into folds on either side of the nose. These folds constitute one of the most disagreeable features of depressed nasal deformities. In this case, within two weeks, the folds had completely disappeared, the tissue having been drawn up into its proper place in the nose. The result in this case was practically perfect. I have recently heard from this patient, and he assures me that the good results have been maintained.

Case 4. A woman, 38 years of age, fell from her cradle when she was three years old, striking on her nose; the injury was followed by a septal abscess. There is no history of syphilis. The nose retained its infantile type, being broad and flat. The deformity became much more marked at about the age of 18. When she was 21 years old she consulted Dr. William T. Bull, who put a silver bridge into her nose; this sloughed out in a

short time. She then came under the observation of Dr. Robert F. Weir, who introduced a celluloid bridge; this also promptly sloughed out. Owing to the extensive sloughing that had occurred, the nasal bones and the septum had been completely destroyed, and the nose was a mass of scar tissue. The nasal

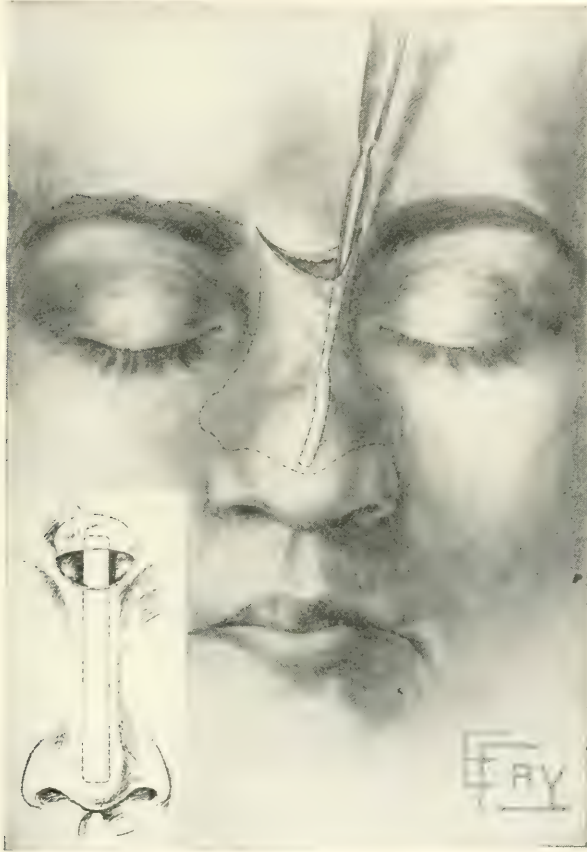


Fig. 9.

deformity was much more pronounced, and in addition both nostrils were completely closed by cicatricial tissue. Four years ago she came to Dr. Harmon Smith, who restored the integrity of the nasal passages and injected paraffin into the bridge, partially building it up. The improvement was great, but there still remained some depression and the cheek folds were very pronounced. About a year ago she noticed a deep furrow developing across the nasal bridge. In March, 1911, she returned

to Dr. Smith, who noticed that there had been some shifting upward of the paraffin. On account of the large amount of scar tissue present he did not regard it as a case for further prosthesis, and referred it to me for bone-transplantation.

The operation was done on March 10, 1911. After removing the paraffin, which came out en masse from its capsule of connective tissue, I found that there was absolutely no support for the bone-graft. In order to support the dorsal piece, reaching from the naso-frontal process to the tip of the nose, I made an inverted V-shaped pier out of two additional pieces of bone; these were introduced through the same wound. The apex of the pier rested under the dorsal strip of bone, and the other ends on the superior maxilla on either side of the nasal notch. This frame-work supported the nose in its correct position, so the wound was closed in the usual manner. Healing occurred promptly, and but for a slight infection which became apparent on the tenth day, and which responded to treatment, recovery was uneventful, the patient being discharged from the hospital on March 30th, twenty days after the operation.

The result, though satisfactory to the patient, could, I believe, be improved by grafting in another piece of bone, as we now have a firm foundation upon which to work.

Case 5. A young man, aged 12, no specific history. This patient's nose was fractured several years ago by a blow from a baseball bat. The nasal bridge was broad, flat and depressed. There was considerable nasal obstruction, due to a thick, irregular septum.

The operation was done on May 10, 1911. In addition to bone-transplantation, I did also the bridge-splint operation, the latter procedure being necessary in order to relieve the nasal obstruction and make the nose narrower by bringing the nasal processes of the superior maxillæ nearer together. Both operations were done at the same time, and neither proved to be a menace to the other.

Recovery was uneventful and the result was entirely satisfactory, and has remained so.

Case 6. A married man, aged 31 years, the father of two healthy children. This patient had syphilis eight years ago, was treated for eight months; there being no signs of the disease, he discontinued the treatment.

Five years ago there began a profuse, fetid discharge from the nose, and several pieces of bone came away. He immedi-



ately began treatment and has kept it up more or less continuously ever since, under the guidance of his physician.

Three years ago the bridge of his nose began to fall in.

Examination showed the nasal bridge to be considerably depressed and flattened. The nasal bones were slightly separated, and running down the center of the nose was a deep furrow, giving one the impression that the upper edge of the septum had dropped from its position between the lateral cartilages; and this no doubt had occurred. The septum was completely destroyed, and there was a large hole in the hard palate, which he covered with an obturator when speaking. The nose and throat were filled with cicatricial tissue, and he was suffering from a very foul rhinopharyngitis atrophica.

The Wassermann test was negative.

Bone-transplantation was done on June 14, 1911.

Recovery was uneventful and the excellent result obtained in this case has remained up to the present time.

Case 7. A young man, aged 31 years, having a congenital depressed deformity and pug-nose. No specific history.

Bone-transplantation July 6, 1911. Recovery uneventful. Deformity completely corrected and has remained so.

Case 8. A young man, 21 years of age, practically blind from choroiditis. No specific history. Patient ran into a post three months ago and fractured his nose.

On examination the nasal bones were found intact and in correct position, but the entire cartilaginous dorsum had caved in, producing a hooked deformity.

Bone-transplantation was done on July 18, 1911.

The deformity was completely corrected. Seven days after the operation there was some inflammation at the site of the incision; the wound was opened and irrigated. After this, healing took place promptly and the patient was discharged from the hospital on August 3rd, sixteen days after the operation.

The result in this case was entirely satisfactory and has remained so.

Case 9. This was by far the most difficult case that I have attempted.

This patient, a young man, 28 years of age, had been healthy up to eight years ago, when he contracted syphilis. The secondary symptoms were most severe, and he was confined to his bed for some time. He has been under treatment at Hot Springs

almost continuously during the past three years, and at times has taken as high as 320 grs. of potassium iodide per day.

Six years ago the nose became involved and large pieces of bone sloughed out; later a very pronounced deformity developed.

Examination showed a very bad depressed nasal deformity. The tip of the nose was elevated and the nasal bridge was folded back upon itself at such an acute angle that free nasal respiration was rendered impossible. The nostrils pointed directly forward. The septum, hard and soft palate were almost completely de-

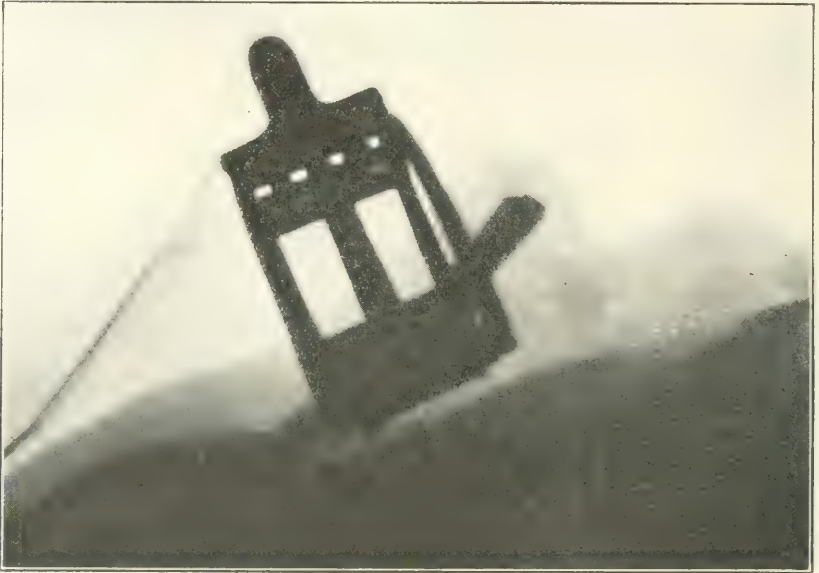


Fig. 10.

stroyed. Cicatricial tissue was present in abundance and there was present a foul and very active purulent rhinopharyngitis. The patient's general physical condition was poor.

The Wassermann test was negative at the time of the operation, which was performed on July 31, 1911.

Owing to the acute angular depression of the bridge, the tissues were elevated only with great difficulty. It was found necessary, on account of the large amount of dense cicatricial tissue, to elevate over the entire nose and far out under either cheek. When the bone graft was inserted, the tension on the skin was so great that it became blanched. This tension was relieved by the bridge-splint operation, which was rendered necessary in order to restore the integrity of the nasal chambers.

The bridge-splint was removed at the end of a week.

The result was very satisfactory, both from a cosmetic and functional point of view.

Sixteen days after the operation there was a slight bulging on the right side of the nose. An incision was made and a small amount of pus evacuated. The wound was irrigated for a few days, and, the discharge having almost ceased, the patient, on account of urgent business, was allowed to return to his home in the West. I have recently seen this patient, this discharge is



Fig. 11.

stopped, the nasal deformity is corrected and the bone is firmly implanted.

The rib in this case presented a very interesting condition; the compact bone was very thin and extremely brittle, so much so that I found it difficult to shape a piece to suit the deformity. I attributed this to the virulence of the disease and the large amount of potassium that the patient had been taking for a long time.

It is interesting to note that in none of these cases did the introduction of bone into the tissues seem to cause the slightest irritation. This I believe is due to the fact that the transplanted bone is of the same chemical constitution as the surrounding tissue; there is, therefore, no antagonism between the two.

None of my cases ran a temperature, and all were discharged from the hospital within ten days, with the exception of Case 8, which was in the hospital two weeks.

The mechanics of the operation involves the principle of the lever; the short arm is fixed beneath the periosteum, the nasal process of the frontal or the nasal bones, as the case may be, act as the fulcrum, and the long arm of the lever does the work of lifting up the depressed bridge. The long continued lifting power of this lever elevates the objectionable cheek folds into their proper position in the side of the nose, and this is one of the most desirable effects produced by the operation.

There is left beneath the transplanted bone a pyramidal space which immediately becomes filled with a blood-clot, and which, in the ideal operation becomes organized. The conditions here are extremely favorable for the introduction of infection; and this I believe will occasionally occur in spite of every precautionary measure. It is interesting, however, to note that infection does not necessarily mean a failure of the operation.

It would seem that syphilitic deformities are amenable to this method of treatment, provided that the disease has been cured, or at least mitigated, as shown by a negative Wassermann reaction. These cases, however, are more difficult on account of the large amount of cicatricial tissue, the atrophic rhinitis and the general condition of the patient.

It is my belief that the transplanted bone continues to live in its new position, and that it receives its nourishment from the surrounding tissues through the medium of an envelope of connective tissue which quickly forms about it.

In this work I have not hesitated to attempt the most difficult cases, and in some instances those which were seemingly hopeless. I feel, therefore, that the efficiency of this method of treating a class of cases for which hitherto so little has been done, has been subjected to a fair test, and that the results obtained should commend it to your serious consideration.

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# THE LYMPHATICS OF THE NOSE AND NASOPHARYNX, WITH CONSIDERATION OF THE GENERAL LYMPHATIC SYSTEM.

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The embryology of the lymphatics, the origin and the function of the lymph fluid have been subjects of controversy for many years. The noted modern authority on the lymphatic system, P. Bartel, of Berlin, suggests that some of the problems can not be solved by science—that they belong to the domain of philosophy.

## HISTORICAL REVIEW.

Historically considered, it is clear that Hippocrates referred to the lymphatics when he wrote about “the glands containing white blood and the veins which take up nutrition and transport it to the glands.” The founder of anatomy, Herophilus, of Alexandria, understood and saw the chyle vessels. He speaks of the “vessels springing from the intestines and which terminate in small glands.”

The proper conception of the lymphatics as a circulatory system was first formed by U. Rudbeck, of Sweden, in the year 1659. As was the custom at that time, he made a public demonstration of the lymphatic circulation in animals which was witnessed by Queen Christina. W. Hunter, of England, supporting Rudbeck, wrote upon the origin and use of the absorbent lymphatic vessels; while Harvey to the end of his life refused to believe in the newly found system of vessels, although he had only a few years before discovered the blood circulation. It is of interest to record that one De'Peissic, of France, a high executioner of criminals, aided in the demonstration of human lymphatics. Prisoners sentenced to be hanged were carefully kept in ignorance of their impending fate, and about one and one-half hours before the time of execution were given a hearty meal, which they relished with zest. Immediately after the execution their bodies were taken to the anatomical institute for investigation. The chyle vessels could be seen full of the recent food and their origin and distribution studied. The contents—a milk-white fluid—was collected for examination.



## METHODS OF INJECTION.

Mascagni, of Italy, in 1789, for the first time traced the lymphatic tracts by means of mercurial injections. Besides this splendid anatomical research work, he contributed to the clinical side by the following: "When the diverse ganglionic groups are affected with diseases, and after having observed the origin of the lymphatic tracts which discharge themselves there—one sees clearly where the remedies ought to be applied in order to cure the illness with which they are affected." We are also indebted to the early French school, especially to Sappey, whose work on the anatomy and physiology of the lymphatics was classic and quoted and reproduced as late as the year 1900. He expressed himself thus. "In the human subject the lymphatic vessels of the nose allow themselves to be injected with great difficulty. It is only through research after research that we come to see them over the whole extent of the pituitary and to follow them from their origin to their termination. In Sweden, Key and Retzius and in Germany, Arnold, Henle, His, Virchow and Luschka added enormously to the physiology and anatomy of the lymphatics. Most important progress was made during the last ten years in the discovery of a new method of injecting the lymphatic tissue by Gerota in Berlin. Instead of the mercury he substituted a mixture of Prussian blue, ether and turpentine and replaced the syringe by an apparatus which slowly fills the lymphatic tracts by gravity. The new method came into use the world over, and through the labor of Most and Buchbinder, Küttner and Bartel, of Germany; Princeteau, Pointer, Cuneo and André, of France, and others, the topography of the lymphatics has been revealed in their finer ramifications throughout the body. The new method of tracing the lymphatics and the advent of the new science of bacteriology stimulated investigators in the search for the avenues of infection.

## GENERAL CONSIDERATION OF DISTRIBUTION AND LOCATION.

While my subject is limited to the lymphatics of the nose and naso-pharynx, it is deemed best to first refer to the general system of lymphatics of which they are a part.

The lymphatic circulatory system is composed of: 1st—The canal system, which includes the thoracic duct with its branches, the lymph channels and the lymph capillaries. 2nd—The auxiliary apparatus, consisting of the lymph glands and nodes, the

four tonsils, the lymphoid tissue of the intestinal and ileocecal region, including Peyer's patches, and, 3rd—The spleen, the thymus glands and medullary system of bones. The contents of the lymphatic system is chylelymph plasma, resembling blood, plasma, lymphocytes and leucocytes. The fluids of the pleura, the cardia, the peritoneum, the cerebral and spinal spaces and other cavities of the body are of lymphatic origin. The lymphocytes and leucocytes for the purposes of defence and lubrication, according to Stohr, penetrate by diapedesis the epithelial layer of the respiratory tract, the alimentary tract and the urinary tract. The lymphatic and its contents represent in animals one-third of the entire body weight.

The lymphatics are characterized by the extraordinary richness in anastomoses. The smaller and larger vessels are variable in size and number and therein exhibit a low degree of differentiation. All the smaller lymphatic vessels before connecting with the venous system have interposed one or more lymphatic glands acting as filters. A further law may be found governing the circulatory function of the lymphatics, and that is the direction of the lymph stream, which, owing to the valvular arrangement, is always in one direction from the periphery to the centre (centripetal). Of practical interest is the fact that the lymph system of one side of the body anastomoses with its opposite. Thus the lymph plasma of organs like the tongue, tonsils and breast is readily transported over the median line of the body to supply the opposite side. The lymph capillaries in their ramifications represent everywhere a closed system of organs and occasionally a cul de sac. Its situation in relation to the blood vessels is deeper; that is, more central. The lymph glands are located in definite regions, in places of predilection and are related to certain territories of cutaneous surface or to certain organs. The gland or groups of glands so related are then called regional glands. The organ or territory which is connected with glands is termed tributary. A group of glands having a vas afferentia and vas efferentia is designated as a plexus of lymphatic glands.

A regression of the structure of the lymphatic system is noted with age and may be regarded as physiological. In early childhood the lymphatics are in full development. The network or reticulum, constituting the filtration apparatus, is most complete at the early age of one year; the number of lymph glands in the child exceeds that of the adult. Repro-

duction of lymph glands and regeneration after disease or removal has been proven by animal experiment and new lymph channels, and capillaries have been found in recto-uterine adhesions. The distribution of the lymph system in the body is as general as the blood vessels. Lymph vessels accompany the blood vessels everywhere, except in the placenta. In certain tissue, as epithelium, cartilage and cornea, lymph vessels are absent. It is certain that wherever the blood vessels are absent, no lymph channels can be demonstrated. In the central nervous system no lymphatics have so far been found. The pulp of teeth was considered to be without lymphatics until recently, when Schweitzer succeeded by the Gerota method in finding them there. There appears to be a definite rule that governs the distribution and location of the lymph system, just as a law governs the formation and distribution of the sanguinary system.

The auxiliary system is composed of simple lymph follicles placed in the submucosa, of groups of lymph follicles, of lymphatic nodes and glands, lymphatic channels in form of capillaries and larger vessels. The follicles and nodes are simple in construction as compared to the glands. The lymph glands placed in the pathway of the lymph channels constitute a filtration apparatus which is comparable in function to the municipal filtration system for the purifying of drinking water. The lymph gland is made up of a network, showing meshes and channels, labyrinthine in character, with numerous inlets, termed *vas afferentia*. The lymph fluid passes through this network of channels to ultimately unite and emerge as one outlet, the *vas efferentia*. This network serves to retain corpuscular elements and foreign substances, and to a certain degree, bacteria. The number of lymph glands thus interposed tend to purify the passing lymph stream, and protect the blood stream from sudden and extensive invasion of germs. Aside from the mechanical filtration of the lymph stream there is a biochemic or lytic effect upon bacteria by the plasma, the lymphocytes and leucocytes, the combined effect of which is to reduce the virulency of germs. However, experiments have proven that under certain conditions the invading germs may pass through the filtration system of glands without reaction on the part of the glands, and enter the venous circulation to produce infection. It will be seen thus that the lymph system represents a capillary network which is tributary to glands or groups of glands connected with the larger lymph channels which ultimately connect by

way of the thoracic duct with the pulmonary circulation. The larger channels are provided with valves, which, under normal conditions, maintain a lymph circulation in the direction of least resistance. It has been demonstrated that the lymph fluid is richer in lymphocytes and leucocytes after its passage through the glands, giving rise to the conjecture that these important cells have their birth within the gland. To test this function, the *vas afferentia*, the inlet of a gland, was ligated, excluding the lymph fluid, and it was found that no lymphocytes were in the gland, although its blood supply, through which they might have entered, was not interfered with. It is reasoned from this experiment that the nutrient lymph fluid carried the substance that provoked a physiological stimulus to the gland, to which it responded by the formation of leucocytes. It has been observed in experimental work upon the alimentary lymph tract that the leucocytes rather than the lymph plasma are carriers of foreign substance, including germs. After gaining entrance the foreign bodies are enveloped by the leucocytes, conveying them to the nearest lymph gland, where they may be retained for a longer or shorter period, finally reaching the thoracic duct, which empties into the general circulation. Here they may then be sifted out by the capillaries of the lungs, the kidneys, the meninges or bones to produce lesions. Thus an infection of the general blood stream finds entry usually through the lymphatic and venous system, often giving rise to diseases such as endo-carditis, nephritis, appendicitis and rheumatism.

The lymphatics of the lungs and thorax are less developed than those of the pharynx and intestines. The construction is simpler, the leucocytes are less in number and the lymph circulation is also less active. Compared with the pharynx and intestines, the lymphatics of the lungs are less efficient in their defence function. No direct anastomosis exists between the lymphatics of the thorax and those of the head and throat, nor between those of the thorax and abdomen. (Attempts to inject by a direct route have failed in animals and upon the cadaver.) However, an indirect route exists between both. The supra-clavicular chain of glands forms an indirect connection between the neck and chest. It is held that infection can only be carried from the neck to the thorax by this indirect route, when a suppurating gland causes a reversal of the lymph current, forcing the infectious material through this indirect route, or the suppuration of a gland may produce an erosion of pleura or

thoracic duct to produce general infection. Direct connection of lymphatic channels between the pleura and lungs and bronchial glands with the abdominal cavity is unknown—only the lymphatic vessels of the diaphragm anastomose with the pleural and the peritoneal surfaces, which, according to Küttner, form the only lymphatic connection between the thorax and abdominal cavity. It is of interest here to state that the lymphatics of the inguinal region are deficient in number and in anastomoses and that the enucleation of too many glands may be followed by temporary elephantiasis of the lower extremities.

#### THE NASAL FOSSAE AND THEIR RELATED GLANDS.

The nasal mucosa contains numerous lymphatic capillaries, situated in the beds of the chorion immediately under the epithelium in general, and, according to the law of Teichman, applied to the lymphatic system, their development is scant and slender where the mucosa is thin and stretched, as in the septum and superior-turbinate and ethmoid region; but, where the mucosa reaches its maximum thickness, as for example in the floor of the nose and in the turbinate regions, they are rich and voluminous. In the turbinate the capillaries form a network of unequal meshes, of irregular sized vessels. This network of capillaries anastomoses over the entire nasal mucosa and forms a perfectly closed system of vessels, just as the sanguinary system, which they accompany. However, two somewhat independent territories are found; the first territory belongs to the olfactory region, the second, the respiratory portion of the nose, both having distinct collectors. The collectors unite in an anterior and posterior trunk. The anterior trunk anastomoses with the vessels of the external nose and becomes tributary ultimately to the submaxillary gland and deep cervical gland. Posterior trunk, the most important lymphatic tract of the nasal fossa is divided into two pedicles which unite on the side of the pharynx directly behind the hard palate and just below the orifice of the eustachian tube, where there exists a true meeting place of the lymphatics of the nasal fossæ and the sinuses (see Plate 1). Some lymphatics penetrate into the eustachian tube for varying distances, while others turn about the superior pole of the orifice, sometimes meeting an interruptor nodule, known as the sub-tubal nodule, situated under the eustachian tube. Thus, a very rich peri-tubular network is found surrounding the eustachian tube, which makes the unskilful introduction of a



catheter somewhat dangerous. The lymphatic tract is continued in two directions—three or four vessels take an outward and downward course to terminate in the deep superior cervical

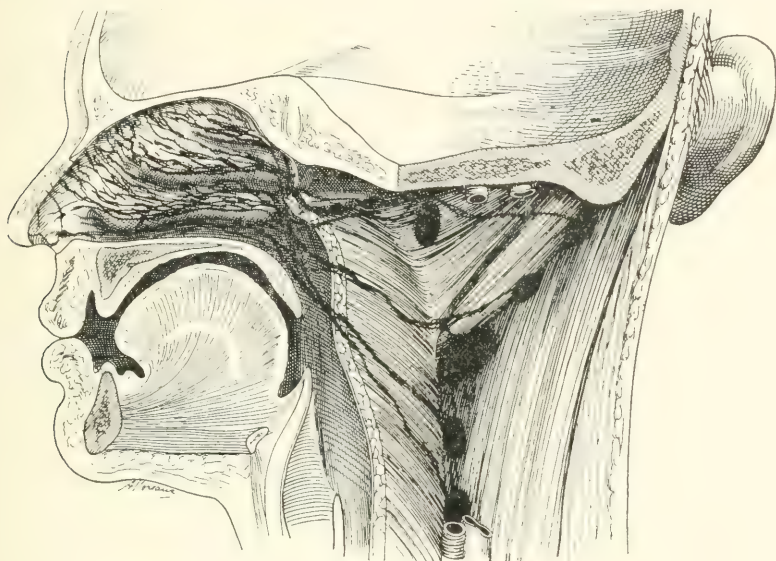


Fig. 1—A.

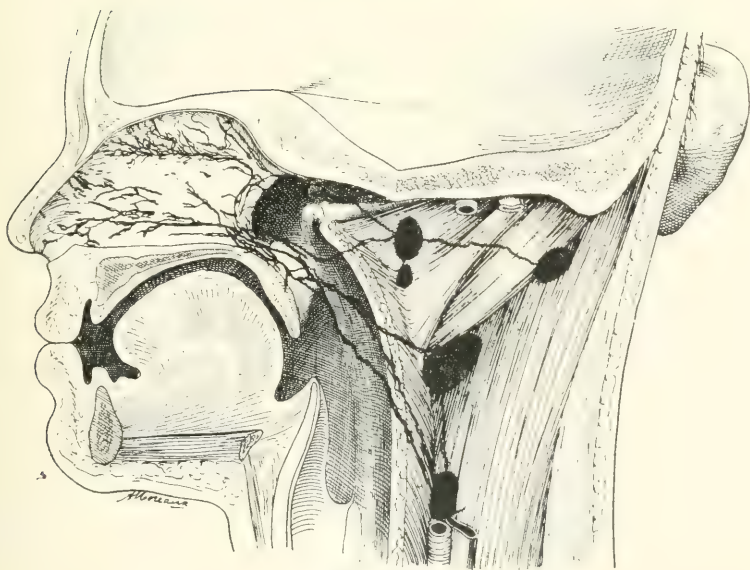


Fig. 1—B.

Lymphatic capillaries of the nasal fossae and septum unite and become tributary to the lateral retro-pharyngeal glands, terminating in the deep superior cervical glands. The nasal lymphatics anastomose with those of the sinuses.—Preparation by Most of Breslau.

gland, while two to four vessels take the direction of the side of the pharynx to become tributary to the lateral retro-pharyngeal gland, which in turn anastomoses with the deeper superior cervical gland (see Plates 2 and 3).

The circulation of the lymph in the nasal cavity is in two directions, partly towards the external nose, terminating in the glands of the face and partly in a posterior direction toward

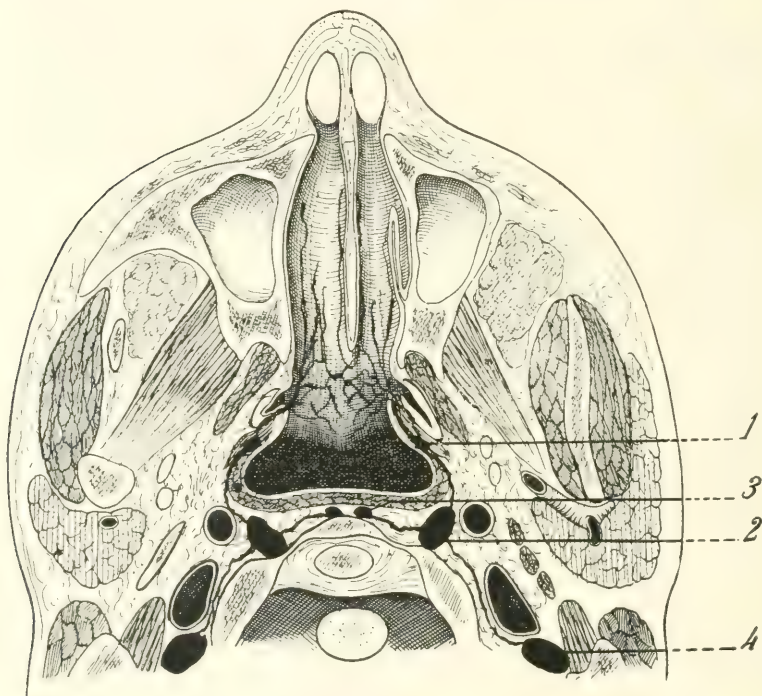


Fig. 2.

1—Sub-eustachian tube lymphatic gland. 2—Retro-lateral pharyngeal lymphatic gland. 3—Retro-pharyngeal lymphatic gland. 4—Superior deep cervical lymphatic gland.

N. B.—The peri-pharyngeal lymphoid ring is concentric in the same way as the portion of the lymphoid ring of Waldeyer. Composed at this level of the pharyngeal tonsil of Lushka, the tube tonsil of Gerlach and the lymphoid accumulation situated on the posterior region of the soft palate. The lymphatic anastomoses is completed by the sub-eustachian tube gland, the retro-lateral pharyngeal gland, the retro-pharyngeal gland and the lymphatic channels of the soft palate.

the pharyngeal ganglions. To summarize, the efferent vessels from the nasal fossae are tributary to the submaxillary retro-lateral pharyngeal glands and deep cervical gland. They likewise anastomose with the superficial cervical, the buccal and the parotid glands.

## THE EXTERNAL NOSE AND RELATED GLANDS.

The lymphatic capillaries emanating from the cutaneous portion of the external nose, the eyelids, the vestibule of the nose, the network of which is very loose, and from the periosteum and perichondrium may be divided into three groups; the superior, middle and inferior. The middle is the important tract, the others being only accessory, and consist only of from three to

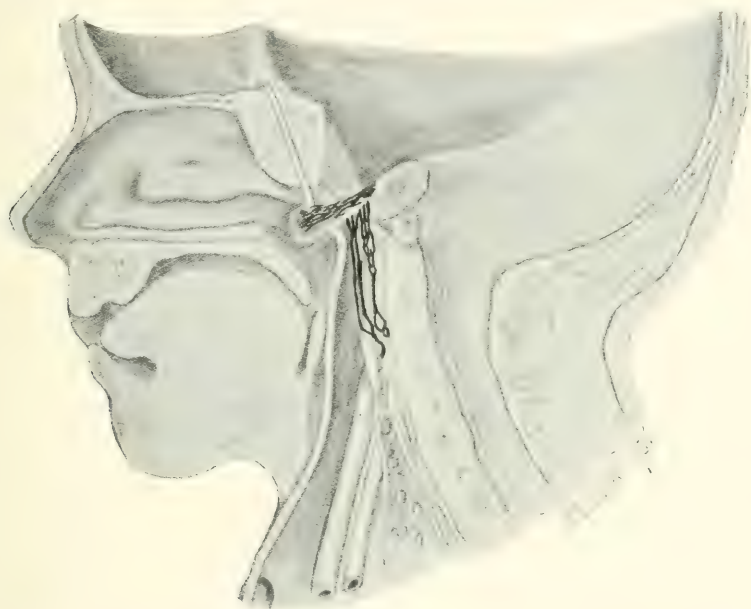


Fig. 3.

Lymphatic channels of the eustachian tube, showing their termination into the lateral retro-pharyngeal glands and the deep cervical glands. They drain the tympanum and tympanic cavity and the mastoid region.—Preparation newborn infant by Most.

five vessels, which after free anastomosis with the ulterior and superior tracts, terminate in the submaxillary and parotid glands. The inferior and superior groups of capillaries arise at the root of the nose and eyelids and both terminate in the parotid glands, which in turn anastomose with the deep superior cervical gland. The lymphatics of the nasal mucosa anastomose with these of the external nose. The lymphatic collectors, which regularly belong to the submaxillary glands, anastomose with the buccal group, situated in the superficial region of the cheeks, which the German anatomists have termed a "Schalt-druse," or interruptor nodule (see Plate 4). These glands are frequently the seat of disease. Recent statistics show 87 cases of disease of the

buccal glands—in 32 subjects it was a chronic tuberculosis; in 4 cases, acute suppuration, supposedly infected from tonsils; 11 cases of carcinoma, originating in the nose and 12 times diseased from caries of the teeth (see Plate 5). Injection was carried along the three tracks and arrested by the buccal group of glands.

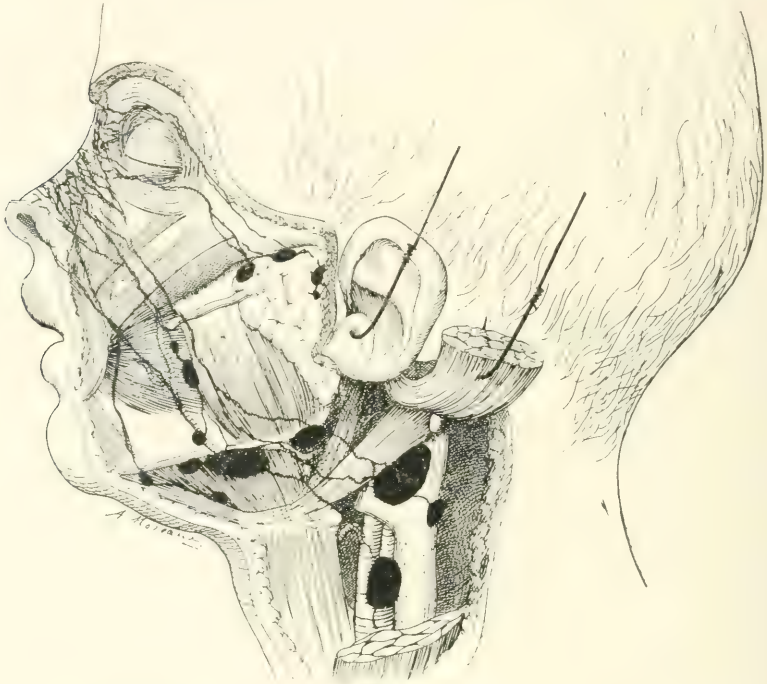


Fig. 4.

The lymphatics of the external nose and the eyelids discharge themselves according to Andre in the parotid group of glands, the buccal and the sub-maxillary glands, which in turn empty into the deep cervical glands.

#### THE PHARYNX AND RELATED GLANDS.

The mucosa of the pharynx is very richly supplied with a capillary network of lymphatics, especially in the region of the lymphoid ring. The efferent lymph vessels leave the pharynx in three places; viz., in the region of the sinus piriformis, in the posterior part of the wall of the pharynx and laterally near the tonsils.

1. The capillaries of the laryngeal part of the pharynx unite to form collectors, which penetrate the mucosa near the sinus piriformis and, anastomosing with the lymphatics of the larynx, become tributary to the deep superior cervical glands. They



perforate the hyoid membrane and occasionally anastomose with the infrahyoid gland.

2. The posterior efferent lymph vessels arise from the dome of the pharynx, the posterior and lateral part of the upper pharynx in the region of the eustachian tube and find exit at two points, first through the muscular wall of the pharynx in the median line penetrating the bucco-pharyngeal fascia, to terminate by an abrupt turn, by direct and indirect route into the

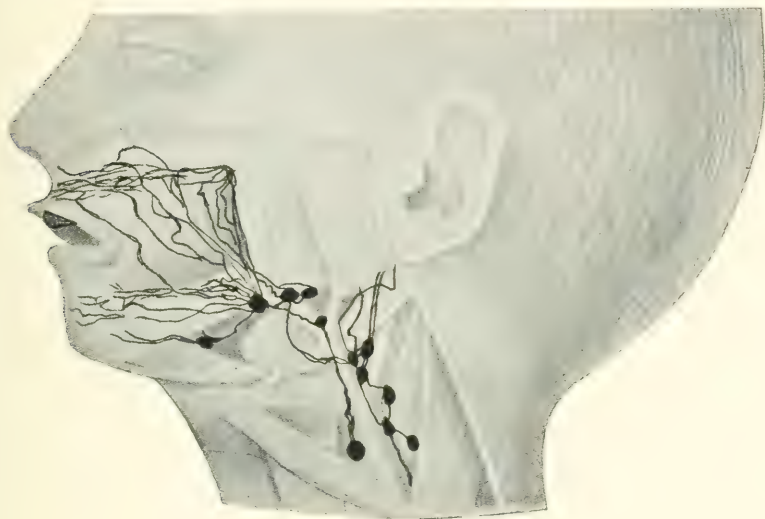


Fig. 5.

Lymphatic vessels originating in the gums of the teeth, showing the termination in the submaxillary group of glands, which consist of three glands, and their ultimate connection with the deep cervical glands.—Preparation by G. Schweitzer on premature born child.

retro-pharyngeal glands, both median and lateral, which anastomose with the superior deep cervical group of glands.

3. The lateral efferent lymph tract is supplied by the pillars and tonsils which are tributary to the superior deep cervical glands and occasionally anastomosis is found with glands of the trachea.

#### TONSILS AND RELATED GLANDS.

The lymph vessels of the tonsils, three to five in number, penetrate laterally the peri-tonsillar tissue, the buccal pharyngeal fascia and the superior pharyngeal constrictor muscle and accompanying the jugular (internal) vein, reach the deep superior cervical gland. One or more lymphatic vessels from the tonsil take the direction anterior and sometimes posterior to the internal jugular vein to empty into one or two glands located under



the posterior belly of the digastric muscle and covered by the sterno-cleido mastoid muscle (see Plate 4). These two glands located near the digastric muscle connect with the deep cervical glands. In fact, the lymphatics of the nose and pharynx, the tonsillar ring, the teeth, the mouth (see Plate 6), all anastomose with each other. The median line forms no border, the two

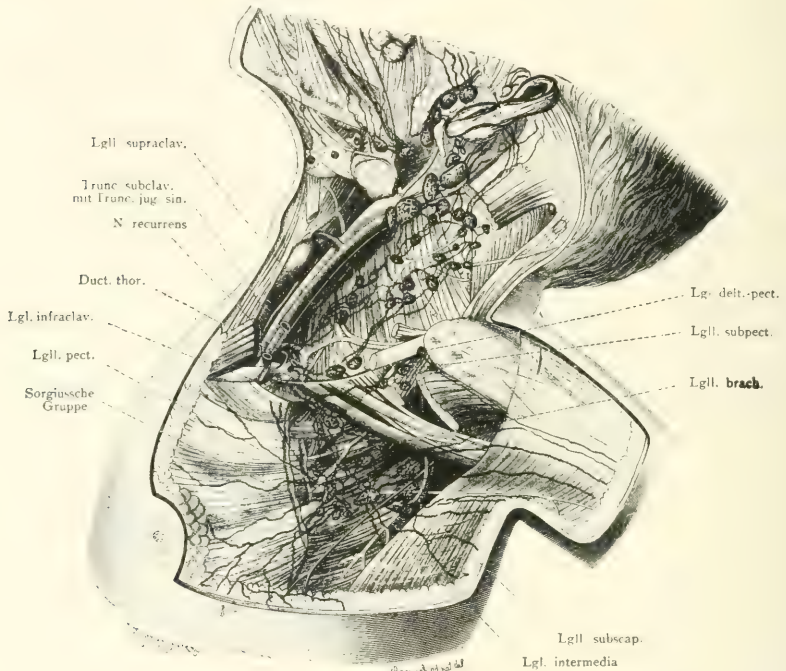


Fig. 6.

Lymphatic glands and channels of the face, neck and axillary region. Then the supra clavicular group. The entire lymph of the head and neck passes into the venous circulation. A direct connection between the glands of the neck and thorax has not been demonstrated.

sides are connected by anastomoses. All the lymphatic glands of the head and face become united with the superficial and deep glands of the neck (see Plates 6, 7 and 8), of which altogether there are probably two hundred in number. While the glands exist in definite groups and are related to organs or territories, they eventually become tributary to the supra-clavicular glands which empty into the venous circulation.

#### THE NASO-PHARYNX AND ITS RELATION WITH TONSILS.

The intimate lymphatic relation of nose and tonsils was proven by the very interesting experiments of V. Lenhardt, of Budapest.

He injected eighteen dogs with China red in the nasal mucosa of the turbinate bodies to determine the direction of the lymph stream *in vivo* and to trace the lymphatic connection with the tonsils. The dogs were chloroformed and killed from two to seven days after the injection, when an examination was made of the parts, the red inert matter aiding to find the lymphatic tracts. His conclusions were that lymphatic channels connect the nasal mucosa directly with the tonsils; that the lymph stream *in vivo* is in the direction toward the tonsils—his experiments corroborating the assumption on clinical grounds by B. Frankel,

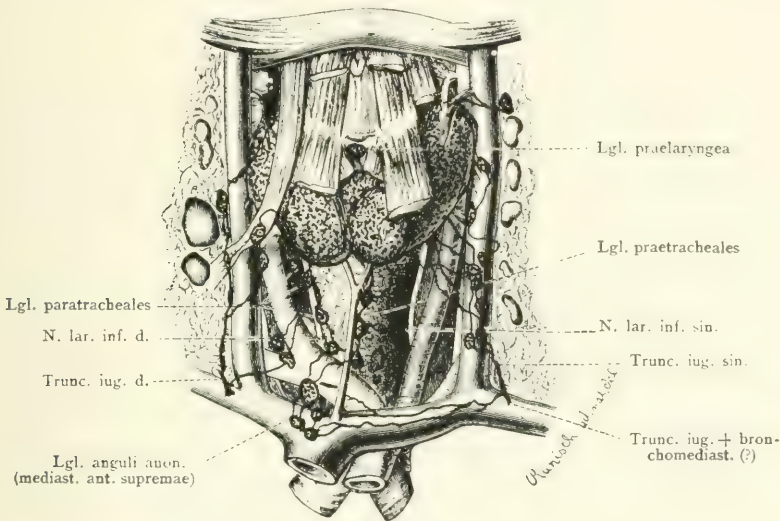


Fig. 7.

The anterior deep cervical plexus of lymphatic injected from the thyroid gland by Bartel in a newborn child. This group of glands are regional to the trachea larynx pharynx and the thyroid gland and their channels are tributary to the supra clavicular group and the thoracic duct. The recurrent nerves may become affected by pressure of these glands, resulting in aphonia in cases of carcinoma of the larynx or oesophagus.

that the tonsillitis secondary to operation upon the turbinate bodies is conveyed by the lymphatic connection and that the infection is not by continuity of tissue nor by way of the blood. Further, that an infection of one side of the nose may be carried to the tonsil of the opposite side. V. Lenhardt found the colored substances within the body of the leucocytes mostly in the deeper portion of the tonsils. The microscopic pictures revealed that the leucocytes were migrating towards the surface of the tonsils. These experiments would lead to the assumption that the tonsils are frequently infected secondarily in acute infection of the nose and the accessory cavities and the naso-

pharynx. The lymphatic connections between the tonsils and naso-pharynx are sufficiently intimate to constitute the tonsils as related glands. Just as an otitis media may originate from an infected naso-pharynx by way of the lymph channels, or, which is rarer, a meningitis through the lymphatics of the cribriform plate or the sheath of the olfactory nerve, so may

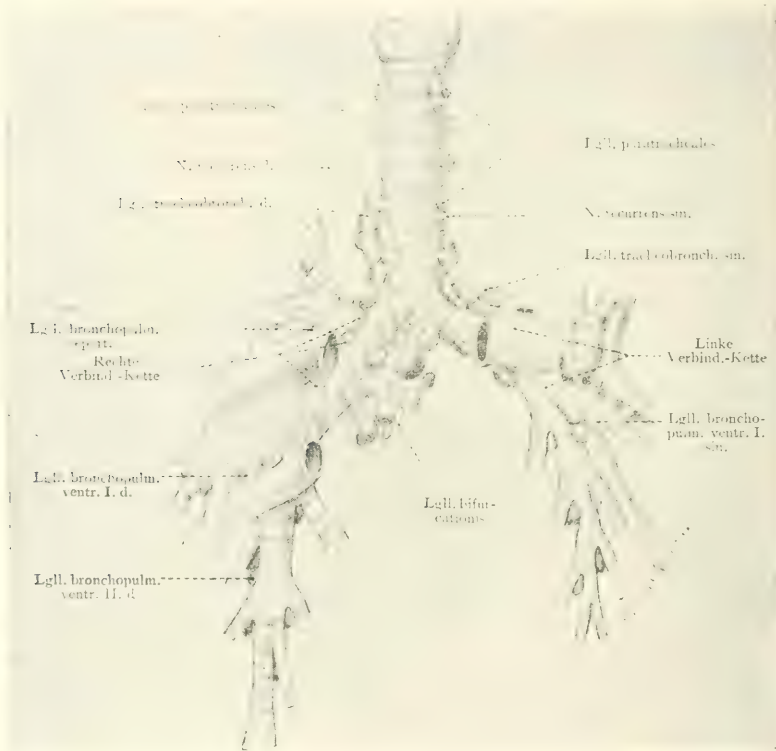


Fig. 8.

Para-tracheal and bronchial lymphatic glands, are regionary to the lungs, bronchi and trachea and diaphragm, and become tributary to the supra-clavicular group, the indirect route and directly into the truncus-broncho mediastinalis, which empties into the subclavian vein and thoracic duct.

the tonsil be infected by way of lymphatic channels. It is probable that every inflammation of the mucosa induces a swelling often imperceptible of the neighboring lymphatic glands, of greater or less extent, which, acting as a protective mechanism, inhibits the development of the germ. To the tonsils, which have the function of a lymphatic gland, may be ascribed a protecting influence against the micro-organism which are ever present in the mouth and naso-pharynx, acting also as a bar-

rier against their invasion into the trachea and œsophagus. On the other hand, it must be admitted that the tonsils are frequently the seat of primary inflammation and that they are more susceptible to disease than other membranous structures in this region.

#### NASO-MENINGEAL ROUTE.

By sub-arachnoid injection in four human subjects of an age

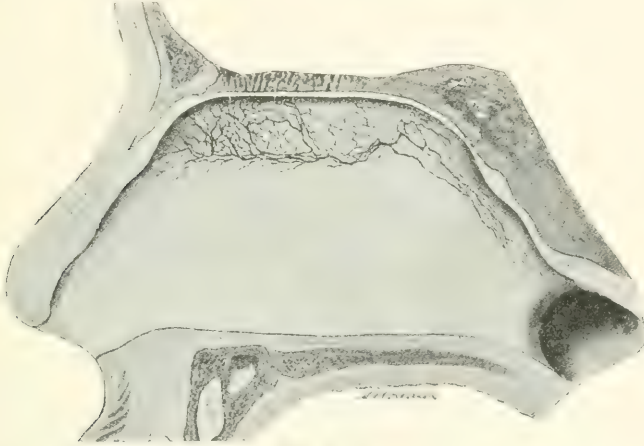


Fig. 9—A.

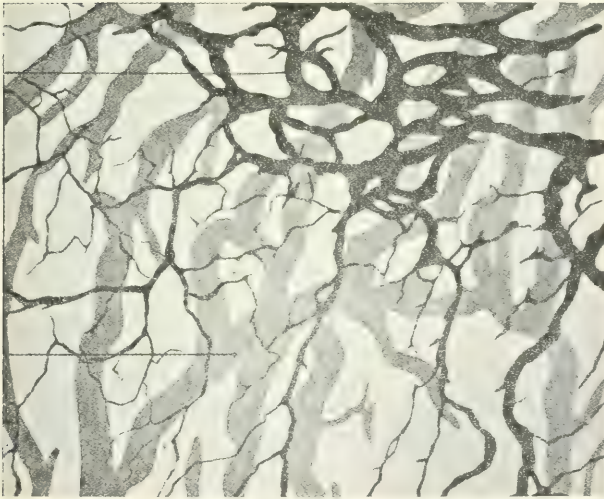


Fig. 9—B.

The naso-meningeal tract in man. By subarachnoid injection in four infants Andre of Paris demonstrated the existence of two independent routes. The first by little canals through the cribiform plate, and the second through the perineural sheath of the olfactory nerve, both connecting with the sensorial portion of the nasal mucous membrane. 1—Injected lymphatic channels. 2—Injected blood vessels.



varying from one to four months, André was able to inject the nasal meningeal lymphatic tract, as proven by histological examination.

It was shown that the lymphatics of the peri-meningeal spaces and the lymphatics of the nasal fossæ connect by means of little

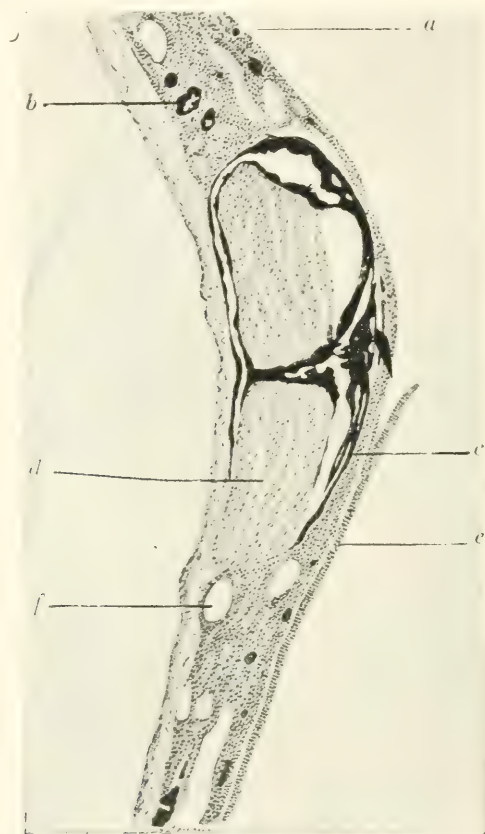


Fig. 10.

Naso-Meningeal tract in a rabbit. Perpendicular cut by Andre of Paris, showing: a, superficial lymphatical vessels; b, deep lymphatical vessels; c, sheath of the olfactory nerve (injected); d, olfactory nerve; e, epithelium; f, blood vessels.

canals crossing the ethmoidal cribriform plate (see Plate 9). The territory injected seems to belong entirely to the olfaction field; that is, the sensorial mucous membrane. There also appears to be a very marked, if not absolute, independency between the system of the perineural sheath lymphatics and the lymphatic network of the nasal fossæ, communication between these being obtained only through excessive pressure of the syringe (see Plate 10). These naso-meningeal connections might, then, be



regarded as homologous with the communications which exist between the peri-ocular and labyrinthian spaces. Thus an infection may travel through the lymphatic channels from the nose or naso-pharynx to the meninges and produce a purulent meningitis or pneumo-coccus of influenza meningitis. The germs of cerebro spinal meningitis or polio-myelitis may be transferred through the cribiform plate or through the sheath of the olfactory nerve.

#### SINUSES.

The lymph capillaries of the maxillary sinus are richest in network on the floor of the antrum; they terminate with those

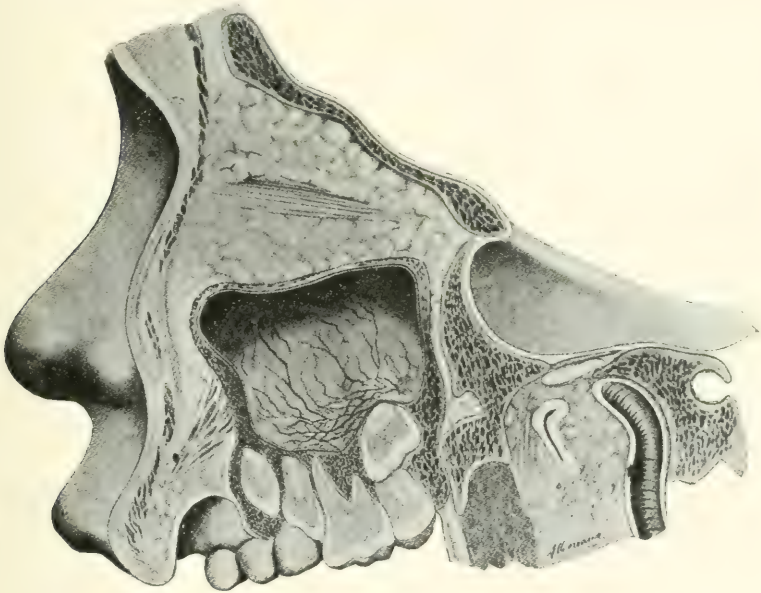


Fig. 11.

Lymphatics of the maxillary sinus of a child in the second stage of dentition. By André. The lymphatic channels pass through the orifice of the antrum and terminate in the nasal fossae, anastomosing with the nasal lymphatic. It is believed that these channels also perforate the facial skeleton to unite with the lymphatic vessels of the face.

of the nasal fossae, passing through the orifice of the antrum and through the thin plate of the posterior nasal fontanelle. When forcible injections were used, the little clusters of lymphatics were injected, supplying the periosteum, and André has seen a very fine network penetrate the periosteum and thin plate of bone, becoming visible at its opposite face. By injecting the posterior wall of the maxillary sinus (see Plate 11) André has seen several lymphatic channels lose themselves in

the tissue where it was impossible to follow them. André is making experiments to discover if there exists lymph communication, as certain authors think, between the ethmoid cavity and the orbital cavity. The ethmoid cavity contains extremely fine meshes of capillaries, visible only with the magnifying glass. Clinically, it is fair to assume that infection of the sinuses may be by way of the lymphatic channels transferred to the orbital cavities and thus reaching the meninges. Most believe that the lymphatic channels of the sinuses (especially from the maxillary sinus) perforate through the facial skeleton to unite with the lymphatics of the external cutaneous surface which discharge into the submaxillary glands.

#### SUMMARY.

To summarize: 1st—The lymphatics of the external nose are tributary to the parotid group of glands, the buccal, the submaxillary and the deep cervical. 2nd—The lymphatics of the nasal fossæ discharge themselves in the lateral retropharyngeal glands and the deep cervical glands situated under the base of the skull in the region of the middle of the neck. The regionary lymphatics of the pharynx and tonsils are the medium and lateral retro-pharyngeal group and finally the deep superior cervical, which occasionally anastomose with the lingual and paratracheal.

When we consider the lymphatics of the naso-pharynx and their related glands, we note the following:

1st—The richness of the network of lymphatic capillaries and the frequency of the anastomosis everywhere and over the median line connecting both right and left sides of the nose and throat.

2nd—The fact that the lymphatic system of the nose and throat does not constitute an entire independency; on the contrary, it is joined with the surrounding lymphatics—those of the forehead, the cheek, the eyelid, the upper lip, the external ear, on one side—those of the eustachian tube and soft palate, of the pharynx, of the sinuses of the peri-meningeal spaces on the other side. Thus the regionary glands belong equally to the neighboring territories. This also is true of the lymphatics of the larynx, thyroid, trachea and the bronchial glands. They become tributary to the anterior cervical plexus, which ultimately anastomoses with inferior cervical glands that discharge

into the veins the entire lymph collection of the head, neck and upper breast.

3rd—The lymphatics of the tongue, lips, palate and teeth and floor of the mouth all have intimate connection and discharge into the regionary glands, which are the submental, submaxillary and the infra-auricular—the posterior part of the mouth join the lymphatics of the tonsils and all become tributary to the deep cervical situated along the jugular vein.

4th—What interests the clinician and surgeon, especially for purposes of diagnosis, are the location of the glands, the places of predilection and the organs which are tributary to them, or to which they are related. Frequently the infection passes through the lymphatic tract, unperceived, and becomes a concealed infection, producing adenitis which manifests itself by symptoms of pressure such as dysphagia—when the retropharyngeal groups and the sub-eustachian gland is involved—by trismus when the buccal glands of the cheek are infected and by torticollis when the deep cervical group under the sternocleido mastoid muscle is inflamed. The recurrent nerves if pressed upon by an inflamed tracheal gland may induce aphonia as in cases of carcinoma of the œsophagus or larynx.

5th—The tonsils, while frequently the seat of primary infection, may become infected secondarily in acute infectious diseases of the neighboring organs, through the lymphatic channels. The same is true in syphilis and operative procedure in the nose, especially when tampons are used.

6th—The lymphatic tracts play a more important role as carriers of infection than is assigned to them. Through the intimate anastomoses of the lymph channels the infectious material is spread more often than by contiguity or by way of the sanguinary system.

7th—The lymphatic system supplies the material for repair, removes waste and by mechanical filtration phagocytic and lytic action of its lymph constitutes a defence function.

8th—The regression of the lymphatic system with age permits the conclusion that a maximum of danger is offered to the child, because of the ready permeability of its membranes, its richness of network and frequent anastomoses, as compared to the adult; hence the earliest treatment of the affected region of the mouth, nose and throat is indicated.

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## DISCUSSION.

DR. EMIL MAYER, New York:—I feel that the valuable work of Dr. Hartz should not pass without some comment, and indorsement for his truly scientific paper.

It is for us to make practical application of these anatomical studies.

The speaker has laid before us the whole chain of lymphatics rising from the nose and has shown us their connections not only with each other but also in the deeper parts.

It seems to make it clear how an infection arising in the tonsil can get into the circulation, producing diseased conditions like rheumatism, endocarditis, etc.

We can thus readily understand why infiltration of glands is present with a localized condition and also the manner of infection of that rare disease in man arising from the equine race—the glanders.

We certainly are indebted to Dr. Hartz for his valuable contribution.

DR. J. A. STUCKY, Lexington, Ky.:—I wish to emphasize the possibility of infections taking place through the ethmoid and cribriform plate into the frontal lobe. Undoubtedly we have a great many cases of infection of the frontal lobe which give rise to no symptoms, there being no focalizing center there. Since my last report at the meeting of the A. L. R. and O. Society, I have had three other cases, and the source of infection, I am sure, has been through the ethmoid. I am glad Dr. Hartz has called our attention to this method of infection. As I said at the meeting of this Academy at St. Clair we are entering a field in the possibilities of which "there is much timber, tall and uncut," and it seems to me time to begin to think a little bit more about the causes of diseases we have to deal with and a little less about the treatment.

DR. JOS. BECK, Chicago:—I want again to set Dr. Kopetsky right by saying that the Heath operation as I have done it has been in those extreme cases in which we formerly thought we had to do the radical operation. I had one case of a man, a little over 30 years of age, who had a discharge following scarlet fever, with apparent destruction of the drum on both sides, and I did a double Heath operation, and he has two drumheads today and hearing almost normal. I was in Vienna recently and I saw more Heath or modified radical operations there than anywhere else. They are doing a great many more of the modified radical than they do of the radical.

DR. W. C. PHILLIPS, New York (closing) :—I do not feel like attempting to answer the arguments, because they are the opinions of men who have done a great many of these operations. Our various remarks will become a matter of record, and I am perfectly willing to stand by my opinion. I enjoy arguing with my friend Ballenger. I reiterate my opinion that the Heath operation deserves no standing as a sane surgical procedure. It is my opinion that there was not a single case on which Ballenger did the Heath operation, in which a simple mastoid operation would not have accomplished the same results, and with less surgery. The packing of the osseous wound cavity after the radical mastoid operation is not done for drainage, for my conception of the conditions which exist after the radical mastoid operation has been performed is that drainage is not very important. You have no pus if the operation is done right. The secretions you have is blood or serum; so the drainage has nothing to do with it.



BONY SEPTAL DEFLECTIONS REMOVED BY  
AUTHOR'S SUBMUCOUS SEPTAL CHISEL.  
160 CASES.

MYRON METZENBAUM, B.S.M.D.  
CLEVELAND, OHIO.

The principle underlying the correction of a deflected septum is the same principle governing a large portion of all nasal surgery; namely, to establish free drainage of the accessory nasal sinuses which in turn is dependent upon the patency of the nares. It is immaterial by what methods these results are obtained, as long as no functioning tissue of the nose is destroyed, and the nasal bridge is not materially weakened.

Incidental, consequent to or combined with the septal operation, improvement in the cosmetic appearance of the nose may often be attained.

The all-told results will be the better if the operation can be performed rapidly, under local anesthesia, free from pain, with no loss of blood and no injury to the adjacent tissues.

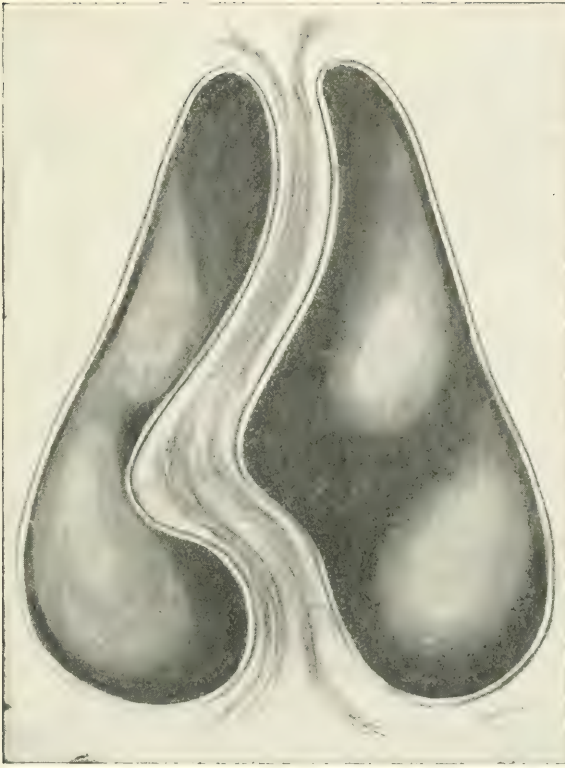
With these ideas in view I present my submucous septal chisel by the aid of which I have successfully performed, under local anesthesia, submucous resections of the deflected septum, involving some bony portion, in an average operating time of fifteen minutes, removing the deflected portion in one entire piece and always retaining the mucous membrane of one side intact, thereby avoiding a perforation.

For the removal of the cartilaginous portion of the septum the Ballenger swivel knife fulfills all requirements. However, there is no single instrument for the removal of the posterior bone portion and bony ridge.

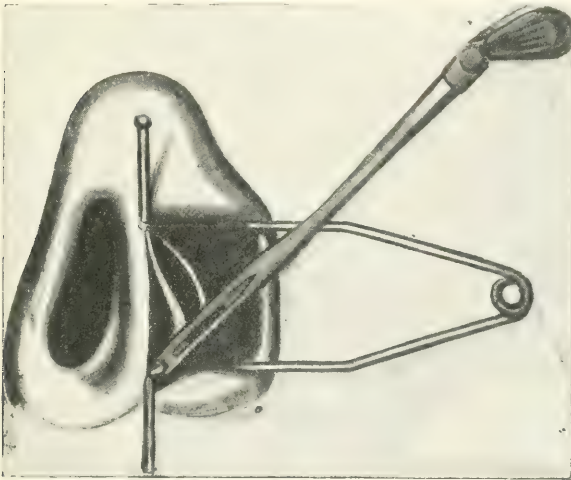
The chisel embodies in simple mechanical form, factors of several of the generally adopted septal instruments.

The chisel is three-sixteenths of an inch in width, half rounded, with two blunt projecting points protecting the mucous membrane and a longitudinal slit in which the severing cartilage or bone may ride. It can be rotated in the handle, which holds it at almost a right angle so as not to obstruct the field of operation.

*Preparation.*—A table of 1/100 gr. of hyoscin hydro-bromide



Cross-section of nose showing marked deflection of cartilaginous septum.



Author's septal chisel in position to engage bony ridge.

is given by mouth one half hour before the operation. This removes much of the anticipated fear and dulls the sensibilities so that a lesser amount of local anesthesia is required. Both sides of the septum are plastered with pledgets of 2 per cent cocaine or novocain, the latter being almost non-toxic. These pledgets are renewed three times in a period of ten minutes, when anesthesia is complete. A  $\frac{1}{4}$  per cent novocain can be injected between the mucous membrane and the perichondrium, which will aid in the anesthesia, and sometimes cause a loosening of the mucous membrane.

The operation should always be planned to keep the mucous membrane of one side intact and to save all or as much of the mucous membrane of the other side as is possible. There is no rule governing on which side of the septum the operation should be started, nor is there any rule as to how or where the mucous membrane should be incised.

The mucous membrane on the upper portion of the septum separates more readily than at the middle or lower portion. Once that the blunt dissector or author's flexible separator is passed straight backwards, it can usually be forced downwards in a parallel plane, straightening out temporarily the deflection in cartilaginous portion of the septum and sheeting off the mucous membrane down to the very base.

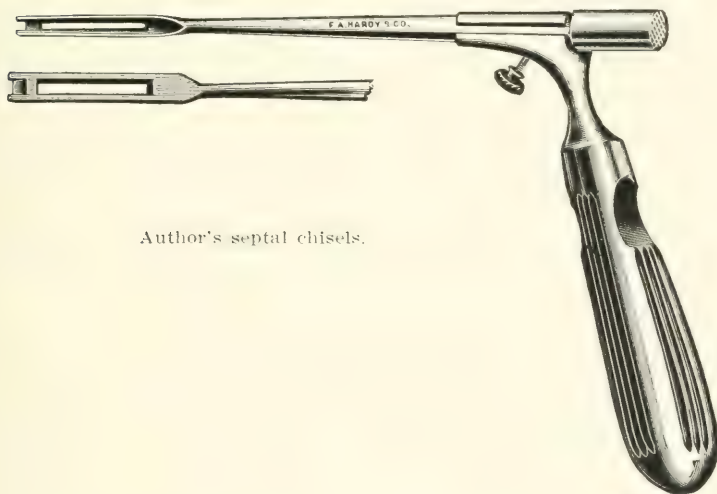
The cartilage is now incised with a not too sharp instrument, and is detected when passing through the mucous membrane by a finger in the opposite nostril. This incision should never be made in the same line as the original incision in the mucous membrane, thereby avoiding a perforation at the lines of incision. The dissector now separates or sheets down the mucous membrane of this side.

The mucous membranes are now held apart by some form of septal retractor, or by the author's flexible retractors, which can be readily bent to suit each case.

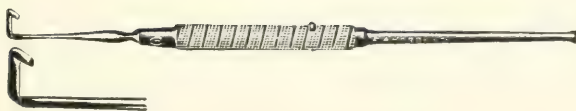
The septum is now exposed to full view and the portion of the septum intended for removal is mapped out with the eye. The author's submucous chisel with concave surface facing downwards now engages the septum at its upper border of deflection, always leaving sufficient support for the nasal bridge, and is forced or driven with a mallet straight backwards until it is just past the posterior end of the deflection. Then it is withdrawn. The chisel is then rotated so its convex surface faces upwards and engages the septum just below its lowermost



Median section showing Hajek-Ballenger elevator separating the mucoperichondrium (Freer).

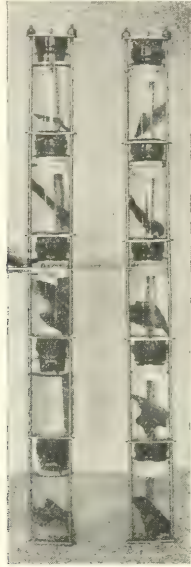


Author's septal chisels.



Author's posterior septal knife.

deflected area, and is now forced or driven backwards until it is again just past the posterior border of the deflection. While the chisel is in this position and the severed septum engaged in the longitudinal slit, the chisel if twisted laterally will very



Author's Specimen Racks.

often fracture the posterior border of the septum. If this does not occur, then the chisel is withdrawn and with the author's posterior cutting knife the posterior border is severed. The usual or ordinary artery forceps or any forceps with wide blades can grasp the septum as far back as the intended line of pos-



Author's flexible mucous membrane retractor. Can be bent to any desired angle.

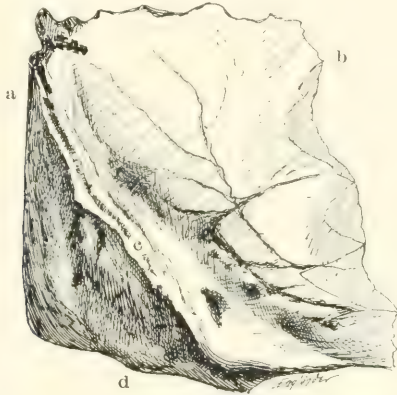
terior clearance, and by a lateral rocking motion snap off this posterior border and then withdraw the severed portion of the septum.

When there is a marked bony ridge, the mucous membrane cannot always be separated. If this ridge is thicker than  $\frac{3}{16}$  of an inch, the width of the chisel, the chisel can be driven right into the ridge; as this is being done the mucous membranes will



break away on both sides. If the ridge is narrow the chisel is turned laterally so as to cut a V at its base, splitting the wall of the septum, leaving a thin layer of the ridge attached to the mucous membrane on one side. This will remove a sufficient amount of the ridge and at the same time save the tearing of both mucous membranes. After the portion of the septum is removed the mucous membrane is brought into apposition and scaled by the Fluid Extract of Benzoin.

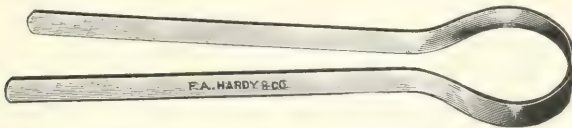
One or two of the author's nasal conforming plugs are in-



a. Ethmoid or posterior bony septum; b. cartilage; c. bony spur projecting one-half inch; embedded into lateral wall; d. bony ridge.

Large bony septal spur and deflection embedded into antral wall, composed of part of cartilaginous septum, bony ridge and posterior bony portion of septum, removed by author's septal chisel. Submucous.

sented. These consist of silk rubber tubing packed with sterile gauze. The serum and oozing cause them to swell, thereby increasing the pressure they exert and preventing post-operative bleeding. These plugs will not adhere to the wound and are withdrawn in from twelve to twenty-four hours.



Author's flexible septal speculum. Can be bent and shaped for each case. When bent like a trough it will retract to the very base of deflection.

The submucous resection removes the pathological obstruction without destroying any functioning portion of the nose. At the same time, it establishes a patency of the nares and free drainage from the accessory nasal sources.

768 Rose Building.

## HISTOLOGY AND MEDICAL TREATMENT OF ACUTE AND SUBACUTE INFLAMMATION OF THE NASAL ACCESSORY SINUSES.

CLIFTON M. MILLER, M.D.

RICHMOND, VA.

The pathological condition present in acute inflammation of the nasal accessory sinuses differs in no way from the pathology of inflammation of the nasal membrane elsewhere, except as has been pointed out by D. B. Kyle, that they pass through the stages with greater rapidity, so that the difference is rather one of intensity. The inflammation is dependent upon inflammation of the nasal cavity which involves the openings and in this way converts the sinus into a closed cavity. Should the inflammation be of great intensity or the condition not relieved by making patent the opening and thus freeing the pent-up secretion, necrosis of the mucous lining will take place resulting in varied systemic disturbances which are toxic in their nature and do not take place with the same intensity as long as continuity of the mucous membrane is preserved. If the walls of the sinuses are thin the neighboring structures are in far greater danger of being involved than is the case where the walls of the surrounding sinuses are thick and difficult of perforation. The mucous membrane is infiltrated with round cells, then there is the pouring out of an exudate which in the beginning is catarrhal in its nature, but later, if the infection is sufficiently violent or the cavity is not drained, it becomes purulent. If the ostium of the sinus is not opened at this time to allow drainage, the process becomes chronic with the ensuing changes found in infections of a chronic nature in this locality for which we have treatment along different lines from that which is to be dealt with in this paper, or else perforation and infection of neighboring structures indicate immediate surgical intervention.

The bacteria found are variable. Pneumococci, streptococci, staphylococci and the influenza bacillus are the most frequent; occasionally the bacillus coli is the exciting agent. Any two or more of these bacteria may be present and seldom do we find a pure culture of only one. It has been stated that most cases of pneumonia are complicated to a greater or less extent by

acute infection of the nasal accessory sinuses which in many instances have preceded the pneumonia, and if this condition had been carefully cleared the pneumonia would probably have been prevented.

In the medical treatment of this class of cases we are unfortunately confronted at the beginning by the fact that the chief local predisposing cause lies in interference with drainage and aeration, which interference is most frequently produced by some obstructive lesion within the nasal chambers. In spite of this, it is the writer's opinion that these cases should be more carefully treated medically than at present seems to be the case and the integrity of the nasal mucous membrane with its underlying bony structure preserved so far as the nature of the condition admits. Surgery is more spectacular in its nature than the simple medical treatment, and the person who has been operated on is more liable to boast of the skill of the surgeon who has drawn much blood from him, than is the patient who has been under the care of the medical man who with effort has produced similar results with regard to the cure of the lesion dealt with. But it seems best that this nasal mucous membrane should not be heedlessly attacked surgically, because if we follow our cases for years after such treatment, we do find sometimes discomforts such as persistent crusting in the nose, nasal hypersensitiveness and various other uncomfortable conditions which the operative procedure has given rise to.

It is not my wish to decry, nor do I for a moment attempt to underestimate the enormous value of surgery in dealing with pathologic conditions of the nose, for through surgery a large part of our knowledge of the pathology of this region has been attained. But, let us not be led away by too great a desire to operate and neglect the treatment of cases that could be cured medically. Were we infected by such infection, would we seek the rhinologist who would make an earnest, zealous effort to cure without operative procedure, or would we go to the one who would advise operation without any attempt to cure by medical means? Put yourself in the patient's place and act accordingly. This, of course, is a maxim older than the science of medicine and almost as old as its art, but it is proper today that we should so act toward our patients. Certainly there are cases, many of them, that upon the first examination present symptoms which demand surgical means for their relief. With these there should be no delay, but let

us not think that every picture of a sinus inflammation is incomplete until there is added a surgical operation.

In the treatment we necessarily bring into the case treatment of the systemic condition which may underlie it, because such infections do not take place unless bodily resistance is lowered. First and most essential is rest and in such a position as will favor drainage from the cavity affected provided you can get the ostium open. A mercurial followed by saline is of enormous importance at the beginning of the treatment. Liquid diet. The administration of aspirin has helped me in many cases. The administration of urotropin has seemed to me on one or two occasions to reduce the amount of suppuration and hasten the recovery, but so great is the variability of the time necessary for the cure of these cases, that a statement of the usefulness of the latter preparation cannot be given unreservedly. Following the calomel and saline, hot lemonade to produce diaphoresis is frequently of great value. The use of atropine or belladonna, having as it seems a selective action upon the nasal mucous membrane, is sometimes valuable, but its use should be resorted to with great care because of its drying effect of the secretion, the flow of which is one of nature's methods of curing the condition.

Local treatment should be directed entirely toward the drainage of the cavities and the reduction of the inflammation. The local application of cocaine 2 per cent solution followed by adrenalin gives the best nasal treatment in the beginning. This should be followed by the use of antipyrin in 4 per cent solution to prolong the ischæmia which has been produced by the cocaine and adrenalin. It seems hardly necessary to speak in this presence of the care with which cocaine should be used, and the fact that it should not be given into the hands of the patient. Should it becomes necessary to use cocaine, where the surgeon cannot personally make the application, it should be given in the form of a spray in the hands of a nurse or some other member of the family rather than the patient himself. The cocaine and adrenalin in the hands of the surgeon are best applied by means of cotton swabs.

A spray of some preparation of the supra-renal capsule in an alkaline medium is safely given to use every two or three hours.

After thoroughly contracting the nasal mucous membrane, direct the attention of the swab to the opening of the sinus or

sinuses involved ; use a warm irrigation of the nose with a normal saline solution to which a small amount of bicarbonate of soda has been added, as this gives comfort to the patient and serves to dissolve the secretion which has been collected in the nose, washing it out thoroughly and getting the nasal chamber in a very clean condition. Following the douche in the nose, which, however, should be used with the greatest care on account of the danger to the ears should any of the fluid be forced into the tympanic cavity by way of the eustachian tube, a spray containing menthol and camphor in an oily medium is of great benefit. In my hands, mild suction by means of an exhaust bulb or the Brawley apparatus after the nasal mucous membrane has been contracted, has proved useful. This should not be used for such great length of time as is found advisable in chronic cases, but it is beneficial when carefully used, not only in emptying the sinuses of retained secretion, but, acting according to Bier's theory of hyperæmia, in helping to hasten recovery. The use of the leukodescent lamp, 500 candle power, over the sinus affected, gives comfort to the patient and reduces the pain. Whether it hastens recovery I cannot now say, but even though its only usefulness is that of relieving the intense pain from which these patients frequently suffer, its use is justifiable. Hot applications over the sinuses favor reduction of the inflammation and hasten resolution. Cold or ice bags in this region seem to me to be contra-indicated, on account of the great danger of their too prolonged use which undoubtedly will cause a lowered resistance and the infection thereby becomes more virulent. Irrigation of the sinuses is an extremely difficult procedure, and in many cases absolutely impossible without removing some portion of the middle turbinate bone. Even in cases where we feel confident that the sinus has been irrigated, such is not always the case, the tip of the canula having entered some adjacent cell. This statement applies more particularly to the irrigation of the frontal sinus than any other. To make absolutely sure that the instrument has entered the cavity, an X-ray plate should be made with the instrument in situ, then we can determine whether the sinus is being irrigated or whether the instrument has entered some blind pocket.

The best solutions for irrigation are normal saline or some other mild alkaline solution. This does no violence to the mucous membrane, and when used warm, as they always should be, the membrane is stimulated to a healthier secre-



tion at the same time it removes the deleterious material from the cavity. Following the irrigation air should be blown into the cavity to dry it as well as possible and to free it from the irrigating fluid. Should such method of treatment not prove successful in relieving the condition within a few days, surgery must be resorted to, though anything partaking of the nature of surgery, even the perforation of the nasal wall of the antrum or the removal of a portion of the turbinate bone, is outside the limits of this paper and will not be considered here.

In subacute inflammations the treatment is much as outlined in acute cases except that general treatment is not so active, and in this class of cases the use of auto-vaccines is of the highest importance and the result attending their use has been such as to encourage us to more persistently pursue this form of therapy. The articles of Levy in *Annals of Otology*, March, 1909, and of Brawley and Patterson in *Laryngoscope*, September, 1910, should receive our most careful attention. In dealing with the subject of vaccine therapy we should not lose sight of its usefulness in hastening the ultimate recovery of acute cases though the length of time necessary to prepare the vaccines (four days) makes it of little value to us during the time of greatest intensity of the symptoms.

In use of the vaccines Brawley has called attention to the practical impossibility of identifying all organisms and he is convinced that in many cases unimproved by vaccines, the real etiologic organism has been crowded out during cultivation by the more rapid and luxuriant growth of other organisms present. From this conclusion, we are led to think that repeated cultures should be made for injection where some form of improvement does not follow the first injection and in this way we may hope to find the etiologic organism. The process is empiric rather than scientific, but in the present state of our knowledge it seems the best we can do. The technique is the usual one for such injections, giving them every five days, though the interval may have to be prolonged a day to get it on the rise of the opsonic index.

217 East Grace Street.

#### DISCUSSION.

DR. JOS. BECK, Chicago:—This is a very timely paper, because we are very much interested in some of the new therapeutic measures that the doctor presented. I really was a little disappointed in the paper, because I expected to hear something in regard to the histo-pathology of this condition. I thought that the doctor would have some histo-pathological

specimens that he had secured, and I was interested to know what condition he would find in an acute or subacute sinusitis. There is not, as the doctor states, so far as I have read and heard other men making the examination, an analogy to be drawn between the mucous membrane of the nasal chamber and other parts of the body. In the accessory sinuses the mucous membrane serves as periosteum, not so in the intestines.

Degenerative processes are entirely different in the nose from what they are in other parts of the body, and therefore no such comparison can be drawn as between a subacute condition of the nose and elsewhere. However, in the examination of a subacute, going on to a chronic condition of the sinuses, I have shown quite a number of these sections, in which we can draw certain conclusions as to the varieties of sinusitis that we have. There is no question that there is too much surgery in the sinuses on the one side, and I know of many cases where there is too little, especially in the so-called subacute cases, with acute exacerbations, and the pathology does explain the degenerative processes that are found.

I was interested in the doctor's statement concerning treatment. Two years ago I presented a paper on vaccine therapy in sinus disease, and in there I stated that to me there was a value in vaccines in the subacute cases. Since then I have gone into this subject very extensively, and, gentlemen, I want to say again what I said here last winter, that the longer I use vaccines in the chronic cases the more I am convinced they are of no value. In the subacute cases they are a good tonic, if we get a good vaccine. I have not seen a single case that I have treated with just vaccines that I would say was cured by that method of treatment. I am continuing this work, however, and may possibly stumble onto something that will be of benefit. I object to blowing out the sinuses. One can easily make a false passage and get an emphysema or infection; and I do not see anything in the drying treatment; there is a suction going on all the time. In the other things I agree with the doctor, except this, I think he does too much treatment in the acute cases. He ought to divide up the subject more carefully, into acute and subacute conditions. In the acute conditions no treatment in the nose, as the process subsides, treatment, or the process of cocaine and adrenalin to open up. The elimination of the toxins from the intestines—that is the proper treatment, with proper diet and rest. It is an acute infectious disease. Now in regard to the douches, nothing better than to pass a fine canula into the sinus, with normal salt solution, will give very much relief to the patient, after the marked acute symptoms have subsided.

DR. E. PYNCHON, Chicago:—We have all been very much interested in the paper that has been presented. Of course it is proper for us to use various treatments in allaying acute and subacute conditions, but in the consideration of sinus disease it is wise to take up the matter of causation. You will never have sinus disease without there is a deformity of the nose. The structural formation deviates from the normal standard, and it is always wise to have in mind the correction of such deformity. The idea of the essayist rather favors allaying the subacute condition and then discontinuing the treatment. In that way the patient goes away with the belief that he is all safe, but the fact is, sinus disease once, sinus disease again. You can allay the acute manifestation, but you are always liable to have a recurrence, because the condition producing the first attack is always liable to produce a second. Meningitis is one of the terminations that we may meet with. Now in order to make it a little more plain: Some of you gentlemen are ophthalmologists, and I remember the time when it was a common practice to advise a patient

with conjunctivitis to take a rest. But the up-to-date ophthalmologist does not treat the condition that way now. He applies such treatment as is necessary to allay the inflammation, finds the error of refraction, gives the patient glasses, and the patient ceases to have a recurrence of the conjunctivitis. What are the glasses? They are crutches to cure the structural deformity of the eye. So it is in nasal trouble; have in mind the correction of the structural deformity which tends to induce the later manifestations. When we have sinus disease the proper way to look at it is as at a house on fire. The first thing is to put the fire out, and then repair the defects of the house. So it is not wise to give the patient the idea that because we have allayed the inflammation he can go through life happy.

DR. W. L. BALLENGER, Chicago:—As has been brought out by some of the speakers, the first thing to take into account of course is the etiology. I agree with the doctor in most of his contentions as to treatment. I believe in the first place that the treatment is usually non-surgical or medical—in acute cases, I mean. But now let us glance for a moment at the etiology to see whether the treatment is rational or irrational. The cause of sinus disease differs very much. In the acute cases there are usually several factors, and in the chronic cases it is usually one of two factors that enters into the etiology. In the acute cases there is usually no structural deformity of the nose; in the chronic cases there is nearly always, also the subacute, structural lesions in the nose which prevent drainage and ventilation of the sinuses. Now what are the causes in the acute cases? Anything that lowers the vitality of the patient; cold feet, wet feet and a thousand and one things that affect the general system. In the chronic cases it is usually a deformity or structural lesion in the nose that prevents good drainage and ventilation in the sinuses. Now we have to differentiate very sharply between the predisposing causes in the chronic and subacute cases, on the one hand, and acute cases on the other. Now what is the rationale of the treatment? The rationale of treatment in the long run is to establish drainage. In the acute cases we have an acute obstruction to drainage, and hence the acute swelling of the membrane which obstructs the drainage and ventilation of the sinuses must first be overcome—the fire must first be put out, as Pyncheon has said. After that the case gets well of its own accord with very little medical treatment. In the chronic cases, which we are not discussing, we must of course remove the obstructive lesion. The leukodescent lamp has been mentioned. I do not know that it cures acute cases, but I do know it helps the cure very much. One chronic case I treated for two weeks daily with the leukodescent lamp—a patient who has a nose full of polyps. I succeeded in stopping all purulent discharge with the lamp and I stopped all pain. Of course, there is a recurrence as soon as you quit. In acute cases it helps very much also. I have in one instance absolutely cured an acute sinusitis with this lamp. I had had acute sinusitis for almost a week, and I lay under this lamp for 30 minutes. Between my house and the office I had used several handkerchiefs. Coming to the office I lay under this lamp, and although I have never duplicated the result, I got up from the table and my nose was perfectly dry and there was never any further manifestation of the disease.

DR. W. W. CARTER, New York:—When we come to consider inflammation in any part of the body we should take into account the fundamental principles of inflammation, which are necessarily a disturbance in the re-

relationship between the capillaries and the surrounding tissues. In the early stage of inflammation, if this disturbance can be controlled the inflammation is aborted and there is no longer any outpouring of serum and corpuscles from the capillaries, the latter perform their function and a normal capillary circulation means a healthy nasal mucosa. Now as to the acute attack of inflammation of both the nose and sinuses. I do not believe there is any local treatment that affords relief, unless it be the introduction of vaseline into the nose, and I find that this does more to insure the integrity of the capillary walls than anything else. I think this property of vaseline is recognized in all the late surgery that is being done upon the arteries by the workers in the Rockefeller Institute. They use vaseline extensively, on the hands, sutures, instruments, etc., and find that it is a great aid in preserving the capillary circulation. Dr. Miller made reference to the hyperemic treatment of sinus affections. It is my belief that in chronic cases there is nothing like producing hyperemia of the mucous membrane before any other treatment is used. To produce this hyperemia does not mean that we must make a vacuum in the nose and sinuses. By slightly diminishing the intranasal pressure we may influence the blood to come to the diseased part and thus assist in taking away the infection. After this hyperemia is produced, applications may be made, and I have found argyrol very satisfactory. Now in regard to the antrum, I think that when there is a secretion in this cavity we should make a perforation in the interior fossa. This can be easily done by introducing a sharp canula, through which the sinus can be irrigated. This is much more effective than any other treatment we can apply to the sinus cavity. In regard to washing out the cavities through the natural openings, I do not think this is practicable in the great majority of cases, and certainly it is not as effective as when a counter opening has been made.

DR. C. M. ROBERTSON, Chicago:—In using the suction apparatus, I find there is a better pump designed by Dr. Pynchon, which does away with the cumbersome instrument of Brawley. In acute cases there is no doubt that suction is of great benefit. In subacute and chronic cases I wash out the sinus.

In many cases I have seen acute trouble disappear in one or two treatments. The general medical treatment consists of abortive and curative measures. In the abortive, calomel plays an important part.

There are two ways of using antitoxins: one as a curative agent, and one as a promoter of increased resistance.

If we wish to produce greater resistance we do not pay attention to the germ which is producing the disease, as the anti bodies of any common germ grown in the laboratory will produce a condition of greater resistance in the body and therefore alleviate some of the disease.

If, however, we wish to produce a remedy for the disease *per se*, we must find the particular germ, and in order to do this it is necessary to make a smear to determine the most predominant germ.

In this way we will find the germ we will have to cultivate, and unless we do this, your antitoxin will be of no value as a curative agent direct.

DR. J. A. STUCKY, Lexington, Ky.:—I have read very carefully Dr. Miller's paper. I am fully in accord with nearly everything he said. I am also fully in accord with most of the discussion of the paper, but as I contended ten or twelve years ago at the Saratoga meeting of the American Medical Association, regarding the treatment of these acute cases, I still contend that the best form of treatment for these acute



cases must be systemic. It is a question as to whether the fever and the toxic symptoms that we have are the result of absorption of retained secretions in these sinuses which have become septic or purulent, or whether it begins primarily elsewhere. I want to suggest to you this treatment in the acute cases: Hyper-alkalinize the secretions as quickly as possible. Put your patient on a very rigid diet, use very little local treatment in the nose. Now what do I mean by hyper-alkalinizing the patient? Giving two drachms of sulphate of magnesia and half a drachm of bicarbonate of soda in six ounces of some carbonated water every hour until the alimentary canal is thoroughly empty, and see how quickly that stuffiness and pain in the head leaves. You may give five or ten grains of asperin, or some anodyne for the pain, but do not give an opiate. If that does not produce immediate and speedy relief you have not done the patient justice until you are sure the entire gut has been cleansed, and then the colon flushing will add greatly to the comfort of your patient. I was formerly a great advocate of treatment by means of a spray of vaseline. I do not use local treatment as much as I did formerly, because the relief *must come from within out*, and not from without in, and I think frequently we do harm in attempting to probe and irrigate these sinuses. If any surgical interference is necessary let that be through the middle meatus, and not elsewhere. If there is pus, and you cannot relieve it by these means, treat it on general surgical principles by making a free opening.

DR. C. M. MILLER, Richmond, Va. (closing discussion):—I am very much obliged to the gentlemen for what they have said. I contemplated doing just what Dr. Beck suggested, but such specimens as I could make were no different from the classics written along that line, and the general surgeons at the time had charge of our dog house and would not let me go in there with any infection, as they were doing a lot of venous anastomosis, etc. Comparatively few of these patients die. I had nothing new in the way of specimens to offer. I think Dr. Beck misunderstood me about the use of antitoxins. I did not offer that as bearing the same relation to this condition as diphtheretic serum does to diphtheria. I simply advised it as an adjunct. In getting the cavity dry, in spite of Dr. Beck's disagreement, I think I do the right thing. It is an air cavity and you must keep it such. Dr. Pyncheon speaks of deformities. My experience has been that it is not so, and then unless it is an acute deformity and if you reduce it, how does it act as a reparative process if you build up the general resistance? We must forget we are rhinologists, and the man who is not first a complete medical man has no place in this line of work. Dr. Ballenger says treat the etiology, along the line Dr. Stucky made his remarks. Of course, we must treat the etiology. We cannot look into the nose and abandon further treatment. I agree with Dr. Stucky's treatment, but I do not agree with his conclusions about alkalinizing his intestines. Dr. Stucky lives in Kentucky, where they have lots to drink and to eat, and the patients are gouty, but in my country they do not live so well.



## IODIN USED THERAPEUTICALLY IN NOSE AND THROAT AFFECTIONS.

CLARENCE WARFIELD, M.D.

SAN ANTONIO, TEXAS.

"Iodin therapy" usually means the administration of iodide of potassium by mouth. Potassium iodide is a combination of iodin 70 per cent, and potassium hydrate 30 per cent. The greater part of commercial iodin is mined in Equador and as such is very impure, being mixed with bromine and chlorine, unless this is sublimed or resublimed its combination with iodin must, of necessity, produce an impure salt. But, when I shall refer to K. I. in this paper it will mean the purest K. I. on the market.

To sum up briefly: Potassium hydrate administered by mouth dries up the hæmoglobin and contracts muscular tissue. Unless quantities of water accompany its ingestion, elimination cannot go on, and salts that cannot be eliminated by skin or kidneys are deposited as liquor potassæ in the tissues, which in itself contracts muscular tissue, dries and hardens the vessels. It is generally admitted that iodin acts only in an alkaline media, therefore there can be little absorption in the average stomach, and not until it reaches the alkaline media of the intestines, but an oil containing iodin or iodide in other forms administered by mouth, combine very quickly with the acids of the stomach, producing butyric and hypuric acids and consequent indigestion. Then again, the elimination of iodin through the kidneys when backed by the alkaline diuretic "potash" may set up a nephritis. If the stomach is acid beyond a degree, the alkali potash combining and liberating the iodin may produce a corrosive action on the stomach walls, and true physiological and therapeutic action interfered with, and innumerable symptoms develop in the gastro-intestinal tract. Syphilitics stand K. I. better than non-syphilitics, theoretically, this may be due to the secretion of stomachs of syphilitics being more alkaline. I have never read of the explanation.

The object of this paper is to present for your consideration as a substitute for K. I. an iodin preparation made for me by

Merck of Darmstadt containing 25 per cent pure iodine in 75 per cent sesame oil which he calls "iodipin," and which I use hyperdermically. Merck has for some time had a 10 per cent solution on the market, which I had used hyperdermically for two years. Believing I could accomplish more with a solution containing more iodine, three years ago I went to Darmstadt and asked them to make me a 25 per cent solution. They were reluctant to do so, stating they had tried it and found it wouldn't keep, so withdrew it from the market. After telling them I would assume all responsibility for loss by chemical change, they agreed to make it for me, to ship it immediately when made, and endeavor to avoid unnecessary delays at custom house and in transit. The first I received had turned from a transparent light yellow tinge to the consistency and color of tar. This was thrown away and the second shipment came, seemingly fresh as when made, and since then by conforming to a rule to give it plenty of light (not heat) I have had no trouble. They now make me 800 grammes every 30 days, which is nearly all consumed in my work, and has been for about three years. Many months of the year I average 20 injections daily. I merely mention this to emphasize what I have thought of its wide field of usefulness, wherever iodine is needed, and I believe you will bear me out when I say that most all of you have considered the danger to stomach and intestines in the use of K. I. to have been secondary in importance to the good the liberated iodine accomplished in diseased conditions met with.

To some minds it might seem as though I were interested in exploiting the product of a special manufacturer of therapeutic drugs, but, gentlemen, there isn't another drug used in nose and throat work that can take the place of iodine, and the question with us is, how can we administer it to get the most effect with the least injury to other parts of the body, and not *who* makes the preparation or *what* they name it. I wanted "iodine-action," not "iodine of potash-action," and these people were the first to produce what I wanted, and I am compelled to so mention.

The stumbling block to the free administration of iodine, in cases where it is most needed, is its action upon the thyroids and para-thyroids. The affinity this drug has for these glands necessitates great caution, in that we do not produce a new

condition or increase one already present, making the last stage worse than the first.

From observation I am led to believe that "iodism" simply means that the thyroid has been unable for the time being, to equalize supply and demand, and where this tendency exists we should stop just short of the point where iodism is produced. In some parts of the body elimination is more rapid than in other parts, and while we may wish for more action in other regions, it is better policy to keep to the amount administered that just stops short of producing much irritation to the organs most easily irritated, this smaller amount continued for some time by equalizing supply and demand, and increased where we find we can do so without interfering with natural conditions, should eventually give the greatest amount of permanent benefit. In my experience this plan gives assurance of favorable action in time, not obtainable otherwise. I do not think we should ever give iodine to benefit any organ or organs at the expense of injury to another, nor is it necessary.

The idiosyncrasy to iodine manifested by some patients is but the same kind of idiosyncrasy exhibited in others to certain other drugs, the explanation of why seems to be theoretical only, but iodism is such a rare occurrence among my patients that I am led to believe the majority stand its administration hyperdermically who cannot take it otherwise.

In simple goitre without "exophthalmus," when administered in the manner I suggest, it seems to act beneficially only, but might, if pressed in these cases increase the condition, particularly the moment when the supply overtopped demand, or when the gland stored up more iodine than it could use or get rid of. The maximum amount of "iodipin" I ever use is 30 M. daily, equivalent to  $7\frac{1}{2}$  gr. of pure iodine or  $12\frac{1}{2}$  gr. of K. I. if the latter all entered the circulation. I have used it in many cases of goitre (never with exophthalmus), and never in a single instance have had any bad symptoms develop.

The cases adversely reported, and there are many, as far as I can ascertain, used K. I. or the iodine was absorbed through the broken skin. The internal administration of K. I. may have acted as a depressment to an already depressed physical and nervous system and thus increased the activity of the goitre. Disturbed thyroid secretion can cause

digestive disturbances and mucous membrane congestion. As these small doses of iodine tend to stimulate a thyroid to normal activity, an enlarged thyroid may become reduced in size under such treatment. Under-secretion as well as over-secretion may enlarge a thyroid. Iodine in small quantities certainly improves the former, and does not seem to increase the latter, unless all my patients have lacked the idiosyncrasy or have been cases where the enlargement has been due to under-secretion, and this I do not believe. On the other hand, Ohleman states that he cured an exophthalmic goitre on himself by prolonged iodine treatment, he having had an inherited tendency to the affection. He used very minute doses over a period of four years. It is possible that in a sensitized subject to iodine who has been treated with iodine, an "anaphylaxis" may be produced, manifesting itself in an enlargement of the thyroid, but these cases I do not think represent either necessarily "under-secretion" or "over-secretion" as regards the glands, more a poison irritation or temporary inflammation. Marine claims that the hyper-secretion of the thyroid in goitre is a *quantitative* increase, but really a deficient *qualitative* secretion. This seems plausible, and if so, then why should not minute doses of iodine improve conditions by improving the quality, and as this lack of quality tends to produce arterio-sclerosis, then why should potassium be administered at all, for certainly it would increase the hardening of the vessels.

In therapeutics (Jour. A. M. A., Dec. 17, 1910), this mention is made: The greater the blood supply and the greater the amount of simple hypertrophy, the more it points to "over-secretion." The greater the amount of colloid material with formation of cysts points to ordinary goitre. The greater the amount of colloid tissue and fibrous tissue development, the nearer comes the gland to "under-secretion." In a beginning simple goitre small doses of iodine may be of benefit and iodine may be of benefit in the first stage of an exophthalmic goitre, the thyroid gland enlarging because it is short of iodine, in such condition the administration of small doses of iodine are of benefit and a large thyroid under such treatment will often become smaller and the early symptoms of Graves disease be inhibited. Such a gland may be, however, exceedingly susceptible to iodine and a little iodine may precipitate all the Graves symptoms, or the patient and the thyroid may

stand small doses of the iodine, while large doses would positively do harm. If any or all symptoms of irritation should be present after iodine administration in small doses, I would stop the administration and expect a gradual subsidence of all symptoms.

I have never been able to get the same quality of effect or to produce the same change in the metabolism in a patient by administering iodine by the mouth as can be obtained by giving it directly into the circulation.

Goldflam mentions a case of syphilitic tabes treated by subcutaneous injection of iodipin (doses not mentioned) in which, while the tabes improved, Basedow's symptoms suddenly became manifest, but after suspension of the drug, the symptoms completely subsided. In this single instance I have been able to note this—undoubtedly he used a dosage large enough to have produced these symptoms in one where even no idiosyncrasy existed, had he used smaller doses he probably would have made no perceptible change in the tabes, but would not have set up a Basedow.

A. R. Short mentions a case of exophthalmic goitre which became manifest after one-half ounce of iodoform with iodoform gauze packing in the wound in the peritoneum of a woman, which disappeared on cessation of the dressing, but he states that in his experience iodoform affects one quicker than iodine, therefore he would use the latter when possible. This I think was also a case with an idiosyncrasy.

Briefly then: the only hindrance to the use of iodine whenever we need it rests with its possible harmful effect upon the thyroid; when given in small doses directly into the alkaline blood, this danger is practically of no import. The iodine rash I do not meet with except as a rarity, and true iodism never. That the mucous secretions are increased there is no doubt, but this is practically the only disagreeable evidence of its administration. If the rash should appear it quickly subsides on stopping the injections, then upon their continuation it rarely reappears.

Hay fever, regardless of cause or time of year of onset, means that certain structures within the nose, particularly under certain conditions, are so far below par or normal as to become the seat of intolerable symptoms. When Dunbar's serum treatment first made its appearance I did not use it, but have followed with interest the results published from



time to time by others. These reports led me to believe that should one have a given case of hay fever (induced by a special specific exciting cause), if an anti-virus could be produced from the excitants and injected into the sufferer, there might be relief. This could possibly be accomplished by making an autogenous vaccine from the secretions, but the procedure would be a most laborious one, and the work of ascertaining the individual or collective excitants for each case simply makes the application of one specific virus to all cases a foredoomed failure. There seems to be a law that individuals sensitized to a definite proteid can be intoxicated only by that proteid, and relief could only be looked for from a serum made equally definitely. Those who suffer from spring hay fever due to the pollens of spring are not subject to autumnal attacks from the pollens of fall, late summer, and vice versa.

In iodine we seem to have a specific, with proper diet. A remedy applicable to all cases, regardless of just what pollen, dust or climatic changes excited the paroxysm, as its tonic and alterative action is directed to the base or seat of the trouble, namely a devitalized mucous membrane. I believe iodine will act just as well North, South, East or West; I do not believe that results obtained in San Antonio could not have been obtained anywhere; that the location had anything to do with it, and I have to report no failure so far in hay fever, straight and uncomplicated. I feel confident you can get these results at home, no matter where that is. It simply takes time and patience, and where loss of smell is manifest, from whatever cause, there is no drug its equal.

The dividing line between hay fever and asthma is at times a very delicate one. Bronchial asthma, cardiac asthma and all sorts of asthma present about the same physical symptoms, it being simply a question of degrees of intensity.

In a very interesting article by Dr. Meltzer (*Am. M. J.*, Vol. LV, No. 12) of the Rockefeller Institute of New York he writes of asthma as being probably a phenomenon of anaphylaxis (the reverse of immunity).

An asthmatic is one who is sensitized to the action of a definite substance and is attacked whenever that substance is near enough to affect the individual, and the contraction of the bronchioli is due directly to the irritation produced by this substance, whether this sensitization be

inherited or acquired. This is a functional disease and not a neurosis. That anaphylaxis exists in cases of hay fever asthma I certainly believe, but whether in all cases is another question; but whether from this cause or whether an attack is brought on by a stimulation of the broncho-constrictor nerve fibres which run in the pneumogastric nerves (the accepted theory of today), the fact remains that when there are no manifest local causes ascertainable, this disease is the bane of a medical man's existence to solve or find a remedy that acts at all specifically.

Iodin may act in two ways: first by gradually eliminating the toxic agents that set up the irritation; secondly, by gradually structurally altering and strengthening the diseased parts until they eventually become strong enough to resist encroachment. It does act, and beneficially, in all cases I have had under my care. It is slow work, but what have you as a better method? It takes worlds of patience, but eventual results warrant it. As to amount and length of time, this depends upon a number of things: whether hereditary or acquired, how long of duration, and idiosyncrasies of the patients (for the action is much quicker in some than in others), or a severe case of so-called fibroid asthma nearing the point of being an emphysema, where it is a wheeze more or less all the time, a blue, drawn, cyanotic appearance about lips and face. In such cases I first tell them they must expect little, and if their patience holds out they may possibly come out cured. If they are not prepared to practice both patience and confidence in the methods, I do not treat them at all. Experience has taught me to let these people alone. They stop treating shortly after the start or midway between, and then do a doctor more harm than he has ever done them good. Consequently I demand confidence and patience; with these to help me I feel sure it is simply a matter of time only when I will have them made over again and living, instead of merely existing. I treat them the first year for from four to six consecutive months (daily if possible). The next year about four months, and the third year (if necessary) I give treatment from two to three months. These rules are subject to all sorts of modifications; some take more, some less, but results come surely, and both patient and doctor coöperating and working together become so in-

terested in the progress that time flits by and it does not seem so long after all.

Again it is in atrophic rhinitis, whether syphilitic or due to a special organism, Lowenberg-Abel diplococcus, or not, that we get positive results with iodine (given hypodermically). It always seemed to me that when this condition existed with no specific history and not traceable to sinus troubles, it must of necessity be constitutional, but iodine acts beneficially upon all cases, regardless of cause, by the same method as in hay fever and asthma, as a structural alterant, eliminator, and tonic to the mucous membrane.

I will not go into detail as to how the crusts soften and come away easily, how gradually the progress is stopped and the mucous membrane takes on a different appearance and the odor, if present, changed in character or stopped. I merely suggest that you try it patiently in your next cases, of course accompanied by the usual local technique, which alone, all will agree, have heretofore been anything but satisfactory.

Mind, I do not claim a miracle can be performed; these cases cannot be put back to normal, but the changes for the better are certainly invariably noticeable. As in atrophic rhinitis, so in all catarrhal disorders or neuroses affecting the nose and throat. In chronic bronchitis, so-called fœtid bronchitis, old chronic pleuritic coughs, chronic tracheitis or chronic laryngitis, and all coughs where it seems a difficult matter to trace back to the cause, one can do no harm by its administration, and the benefits derived will more than pay for the experiment. It is the only drug that will affect a fœted bronchitis. The fœtor gradually changes until no odor is present in the secretions. The microscopic examinations from time to time show you the difference. It facilitates absorption or elimination of pathological secretions in any part of the body, and in old pleuritic adhesions its alterative action is markedly manifest.

In incipient phthisis is where I feel confident we can also accomplish much. Iodine (as one physician wrote me, whose patient I was treating for this trouble) liquifies the tubercular masses, which might under other favorable conditions "dry up." I answered that it was on account of *this* action I used it, rather than depend upon a drying up process, with a possibility always existing of activity being set up and con-

sequent insidious spreading. In those cases not far advanced I have endeavored to liquify what little there is and by nature's natural drainage apparatus (the tubes) carrying off as quickly as possible all that should not be there. Experience has taught me this is much the safer plan; the other way seems to smother conditions and trusts to luck, feeding and hygiene, that accidents will not occur. As the last mentioned are of course adjuncts always, it is just possible that they did the good work, but I believe the iodine helped matters materially when given in small enough doses to suit the given case. I believe also that when so many instances are reported of harmful activity being set up, it was either with K. I. or a case of too much iodine; as to the latter I think it might do incalculable harm, just as too much tuberculin does. I *never* use iodine in advanced or third stage cases, for the reason that I *do* use it in the incipient cases, namely: too great a liquifaction, too much activity and placing too great a burden upon tubes and larynx.

In cases of laryngeal tuberculosis it is the greatest help I have, in conjunction with local antiseptics and sedatives. To state just what class of cases should improve would take up too much space and impose too much upon your patience. This, one will have to figure out by feeling the way carefully, but this I will say: do not be afraid of *small* doses hypodermically of iodine, together with other treatment. I do not believe any harm has been done in a single instance where care has been exercised, and in all cases that have recovered is my practice (and there are some) I have invariably used iodine. If there be present in a patient sarcoma of the breast or glands, do not use iodine for the affinity of iodine to glandular tissue invariably stimulates what might be an innocent sarcoma into a very active one, which action seemingly progresses right along after its administration.

As to the technique of administering iodine hypodermically, draw into a glass syringe 10, 20 or 30 M. of iodine, adjust an ordinary No. 24 Peerless Seamless steel needle, heat glass barrel over a burner until solution is sufficiently liquefied, press out all bubbles by holding syringe needle point up; give injection between skin and fascia only, over any part of the back, and occasionally over chest—but subcutaneously into gluteals (but not deeply) when the back must be rested up. Do not inject it in the same place again

for at least a week, as there is danger of cellulitis or abscess formation. At first I probably averaged one weekly, now I do not average one a year, though I invariably tell a patient an abscess may form at any time, but that such an abscess is easily handled. This protects the doctor and does not disagreeably surprise the patient if an abscess should occur. It takes patience, faith and perseverance, and one commencing will find lots of drawbacks, but the result in the end will justify all the trouble one goes to, and once the technique has been mastered one will not regret having persevered.

#### DISCUSSION.

DR. OTTO J. STEIN, Chicago:—I regret that the paper was not read in its entirety. I must admit that I gained but very little from what I heard relative to this particular form of iodine in the treatment of hay fever and asthma, and probably because the doctor did not have time to read his paper in full. It is an old knowledge with all of us that iodine is of value in diseases and disturbances of the upper respiratory tract; so ancient, it is almost ridiculous to mention it, but as to its therapeutic value in these two particular diseases I have no knowledge of any real good ever observed by any one directly due to this therapeutic agent. As a systemic remedy, as a tonic, of course in such diseases it certainly is of great value and is used and recognized by all of us. The great trouble heretofore has been that iodine used in any form recognized now by us and pharmacists, has been that it acts so much as an irritant to the mucous membrane as to be of little value. It is eliminated so rapidly that the irritation is excessive. I can recall distinctly when in medical school our professor of general medicine used to use iodine in various forms, particularly the tincture of iodine, sometimes with the iodide of potash in addition, as in Lugol's Solution, injected into the nasopharynx for asthma—an extremely heroic remedy, I grant you—and if there was any benefit from it it was principally due to its heroic action upon the mind of the patient. That brings me to the very point I want to make. Iodipin is known to all of us, and iodipin used in disturbances of the respiratory tract is well known to all of us. We know that the therapeutics of hay fever and asthma is a variable factor, because any remedy which any enthusiast may select and apply to his patient will invariably bring about relief for the time being, and it may be that the application of this remedy in the hands of the doctor was mainly psychic. I think that is true with a great many remedies applied to asthma and hay fever, excepting, of course, obstructive lesions, but in the great run of cases I think that is true. You can make such an impression upon your patient by the manner and way you apply your remedy, be it what it may, and thereby bring about a most miraculous cure for the time being, and it is possible that that is the element which has entered into this particular series of cases referred to by the essayist. I am extremely skeptical as to the value of any iodine preparation now known, bringing about lasting or permanent, let alone absolute relief to asthma or hay fever symptoms.

DR. E. PYNCHON, Chicago:—Aside from the application of iodine in cases of hay fever and asthma, in which we are most interested, we



want to appreciate very much the fact that the doctor has presented a form of iodine treatment that is best for the patient. I think the great aim of pharmacists should be fully as much towards the development and improvement of old standard remedies as toward the production of new chemical substances with which the market is everlastingly flooded. I will say that others have secured a solution of iodine of the strength recommended, and it has been particularly in the field of dentistry. Dr. Talbot, of Chicago, has succeeded in getting up a formula which, while it cannot be used internally, can be used in the treatment of diseases of the gums. It contains a 25 per cent strength of iodine.

DR. C. WARFIELD, San Antonio, Texas (closing discussion):—Relative to Dr. Stein's remarks on this subject, as regards psychical action, I just want to state that this is not a matter in which snap judgment has been taken. It is a matter which has been gone over very carefully, and from the number of cases I have had, I am sure that what I have said will be borne out by facts. If you will use iodine in this way I feel confident in time there will be no question as to psychic action. Take a case of hay fever which has lasted for five or ten years, presenting itself autumnally or in the late spring, coming directly at a certain time, and then you stop that case, and can look back four to five years without that case having a recurrence, it makes you rather believe that what you have done is not psychic.

## REPORT ON THIRD INTERNATIONAL RHINO-LARYNGOLOGICAL CONGRESS.

DR. M. A. GOLDSTEIN.

Official Delegate of the American Academy of Ophthalmology and  
Oto-Laryngology.

The Third International Laryngo-Rhinological Congress was held in Berlin, August 30 to September 2, 1911. It was, indeed, a pleasure and a privilege to all who participated in this congress to be the recipients of a most liberal hospitality on the part of the city of Berlin, the president of the congress, our esteemed colleague, Geh. Prof. Dr. B. Fraenkel, the members of the executive committee headed by that most active and energetic worker and secretary of the congress, Prof. Dr. Rosenberg, and the fellows of the Berlin Laryngological Society.

Berlin, today one of the modern great metropolises, is especially characterized by its cleanliness, system and order, aggressiveness and incomparable civic energy; in our opinion it stands today as the model, progressive metropolitan city of the world, with these ear-marks of a city's growth. The same spirit and pride that actuates and stimulates the people of Berlin in the development of the great German capital was clearly in evidence in this successfully conducted International Congress of Laryngo-Rhinology. The five days' session of the congress, including its valuable and instructive exhibits, its scientific programs, its sumptuous banquets and social functions, its enjoyable and interesting excursions—all were conducted with characteristic German promptness, care and precision.

The systematic arrangement of the details of this convention was in itself an interesting study. The scientific sessions and exhibits were held in the spacious quarters of the Herrenhaus of the German Parliament. All members of the congress were accorded every possible courtesy and attention and those of us who have attended frequent international conventions, where all nationalities are represented and where a Babel of languages is heard, were impressed by the lack of confusion and the ease with which the numerous scientific and social functions were systematically conducted. Much credit is certainly due to the executive committee and especially to its genial and energetic

secretary, Prof. Dr. A. Rosenberg, who seemed to be the guiding spirit everywhere.

The scientific program was, perhaps, a bit unwieldy because of the limited time at the disposal and the large number of papers presented. Unfortunately, an international congress in special surgery occurs at such infrequent intervals that much subject matter is available for presentation and the program is invariably too bulky.

The four symposia were promised as a special scientific feature, but we cannot refrain from expressing our disappointment in the manner with which these symposia were presented; instead of giving them the scientific prominence which they merited in the active sessions of the congress, many of the essayists contented themselves with a very brief resumé of their addresses, and to those of the members who had not previously had an opportunity of carefully reading the addresses in full such a presentation was more or less unintelligible and unsatisfactory.

The first symposium, "The Relations of Experimental Phonetics to Laryngology," was presented by Prof. Gutzmann, of Berlin, and Dr. Struyken, of Breda, Holland. Much painstaking work has been done by these original investigators in this special field and it is evident from the papers and demonstrations here shown that time is close at hand for the crystallization of much of this experimental data and the application of this information to the practical and clinical treatment of speech-defects.

The second symposium on "Bronchoscopy, Esophagoscopy; Their Indications and Contra-Indications," was presented by three of the most active workers and investigators in this modern specialty: Professor Killian, formerly of Freiburg, now of Berlin, Dr. Kahler of Vienna, and our able American colleague, Dr. Chevalier Jackson of Pittsburg. Unfortunately sickness in the family prevented Dr. Jackson's personal attendance at the congress.

Equal to this symposium in importance and interest was the remarkable exhibition of instruments for endoscopy; this exhibit included the entire array of instruments from the first models to the perfected and most recent instrumentarium. These instruments and apparatuses were chronologically arranged and exhibited for the deliberate inspection of each member of the congress. They presented in practical form the complete history and evolution of this important innovation.

The third symposium, "The Lymphatic Apparatus of the Nose and Naso-Pharyngeal Cavity in its Relation to the Rest of the Body," was presented by Dr. Broeckaert of Ghent, Professor Poli of Genoa, and Dr. Logan Turner of Edinburgh. Recent developments have proven the importance of the lymphatic distribution of the nose and naso-pharyngeal tract to general systematic infections and the symposium was a timely one and emphasized the necessity of recognizing these relations.

The last symposium, "The So-Called Fibrous Polypi of the Naso-Pharynx, the Place and Mode of Their Insertion and Their Treatment," was presented by Dr. Jacques of Nancy and Dr. Hellat of St. Petersburg.

The readers of *The Laryngoscope* will have the benefit of perusing the complete monographs comprising these four symposia in its pages.

A few words concerning the splendid exhibit of instruments and apparatuses may be of interest. All of the recent improved instruments and the newer technic were exhibited to best advantage and many of these were demonstrated by the members who devised them. Space will not permit a detailed description, but several apparatus and instruments are worthy of special mention.

A photographic camera has been devised by Leiter of Vienna for taking pictures of the various cavities of the body, especially those concerned in endoscopy. The camera is a small, circular disc that fits over the endoscopy tubes, equipped with electric light that is arranged as a miniature flash-light; the views are taken on a disc plate, permitting eight exposures, and as the objective is a clear and sharp one, these small negatives may be magnified many times without losing much of the outline. We have seen some excellent photographs of the bifurcation of the trachea, of pathological conditions of the surface of the larynx and of neoplasms in the naso-pharynx taken by this miniature camera. No doubt there is an unusual future for apparatus of this type whereby we shall be in a position to more accurately present our pathological findings in our published literature.

A system of treatment of much efficiency and one which has heretofore been given less practical application than it merits, because of the expensive character of the apparatus needed for its accomplishment, is that of a satisfactory inhalatorium. The apparatus exhibited for the first time at this congress by the Inhalations & Baedereinrichtungen Company of Berlin, seem to

supply a very desirable form of inhalatorium; it is a compressed-air-driven apparatus of absolutely dry medicated vapor, developed with such density that it is almost impossible to see the hand at arm's length from the eye when seated in a small room in which this vapor is produced. The air is so dry that clothing exposed to the vapor for a period of several hours shows no trace of moisture. It is furnished in many forms from that of the simple inhaler to an equipment intended for a large inhalatorium, and compared with previous equipments is quite moderate in price. This form of treatment has been very popular on the European continent and such "Kur" resorts as Bad Ems Reichenhall, Salzburg, Salza Maggiore, are world-renowned for the treatment of catarrhal and inflammatory conditions of the respiratory tract. It might be worth while for our American colleagues to investigate this form of therapy more closely.

A splendid exhibition of radiograms demonstrating the position of the tongue and other organs during phonation and Roentgen pictures of the act of deglutition was presented by Dr. Max Scheier.

Dr. A. Musehold of Berlin showed a series of photographs of the larynx made by the old type of camera, with the electric light as an illuminant introduced by glass prisms; the photographed negatives were reproduced considerably enlarged and are adaptable for lectures and demonstrations.

The application of the phonograph and gramophone in experimental phonetics was shown by Dr. Pancancelli-Calzia of Hamburg. The graphic registration of the voice in song and speech was shown in its manifold types in the beautiful exhibition of Professor Gutzmann of Berlin. This demonstration also included an analysis, synthesis and reproduction of the human voice.

Wonderful progress has been made in the instrumentarium for endoscopic work and all of the most recent instruments and their newer modifications were practically demonstrated.

Duemerl of Vienna showed a new series of his beautifully executed stereoscopic diapositives, including the various steps of the hypophysis operation as developed by Dr. Hirsch of Vienna. The collection of Professor Killian of the anatomical evolution and development of the accessory sinuses and numerous new pathological specimens of Professors Onodi, Hajek and others are included in this series.



Among the surgical instrument-makers, Reiner and Leiter of Vienna, Pfau, Detert and Windler of Berlin and Fischer of Freiburg showed many interesting individual instruments. The writer was especially impressed by a new form of snare demonstrated by Erhard. The special advantage of this snare is that the wire is attached to one end of the cannula, the other end is drawn inward through the cannula when the snare is driven home, thus imparting to the loop a cutting action, instead of the usual type of strangulation of the engaged mass. A most practical feature of this snare is that the same wire loop can be opened and reapplied without kinking or twisting the wire, a feature which, as yet, has been absent from every other snare. The valuable collection of pictures of Prof. Gerber of Koenigsberg relating to diseases of the upper respiratory tract, was given individual demonstration.

Professor Gluck and Dr. Sorenson of Berlin exhibited their collection of pathological specimens of extirpated larynges and the patients from whom they were removed.

Dr. Kuhn of Cassel demonstrated his device for peroral intubation, a method by which preliminary tracheotomy is dispensed with in radical operative procedures about the pharynx and larynx.

This brief sketch of the congress would be incomplete if we failed to mention the interesting excursions and elaborate social functions provided by the executive committee. The general banquet of the congress, in which all of the members, officers and their ladies participated was a magnificent function. The vast and imposing banquet hall of the Rathaus has probably never before contained such a galaxy of the laryngological profession of the world. It was, indeed, an impressive sight to see the officers of the city of Berlin, with their designated regalia; the representative laryngologists of many countries, most of them in full uniform and decorations, the ladies in their brilliant toilets; the lavish banquet board and floral adornments, and our few American colleagues in their simple evening dress, with that wonderful painting of the German master, Anton von Werner, "The Congress of Nations," at the far end of the banquet hall, forming a fitting background to this memorable picture.

The excursion by boats to Wannsee and the Swedish pavilion was but another evidence of the lavishness and resourcefulness of the managers of the congress. After the bountiful luncheon,

a very interesting, clever and humorous travesty on Salome was performed for the edification of the congressionalists. The burlesque was the creation of Dr. Alfred Peyser of Berlin, and teemed with constant allusions to laryngological and rhinological data in most grotesque form. The context was printed in the three languages of the congress and produced a continuous ripple of merriment. A fitting climax to these social activities was a visit of the delegates *en masse* to the Hygienic Exposition at Dresden, after the close of the scientific sessions.

There is no greater pleasure to the hard-working, active laryngologist than that afforded by an international congress of this character; the memory of the more intimate association with so many masters in laryngology will linger in our mind for many years. It is certainly an unusual pleasure and stimulation to come into personal touch on terms of professional and social fellowship with such masters as Professors Fraenkel, Killian, Denker, von Bruns, Manasse, Friedrich, Brieger, von Eicken, Gutzmann, Rosenberg and Spiess of Germany; Chiari, Onodi, Kahler, Koschier and Hirsch of Austria-Hungary; Thomson, Tilley, Grant, W. Williams, Milligan, Turner and Patterson of Great Britain; Luc of Paris; Siebenmann of Basil; Uchermann and Schmiegelow of Scandinavia; Von Stein and Hellat of Russia; Gradenigo, Grazzi, Ferreri and Lasagna of Italy; Botey, Botella, Cisneros of Spain; Burger and Struyken of Holland, and many others, together with the modest representation from among our own American colleagues.

In conclusion, just a word about the ladies. Many of the members of the congress were accompanied by their families and it was an added pleasure to see the interest and participation of the wives, daughters, mothers and sweethearts of the congressionists, especially in the many social attractions arranged for them by the ladies' committee and the executives of the congress. Our ladies had an opportunity of meeting the men who are our masterful co-workers in all parts of the world in our life-work and of enjoying with them the lavish social entertainments of the festive week of the congress.

In 1913, the Fourth International Congress of Rhino-Laryngology will convene at Copenhagen, the active metropolis of Scandinavia, under the presidency of Professor Schmiegelow, to whom we tender our congratulations on this occasion for the high honor conferred upon him.

## THE PHYSICAL BASIS OF OUR CONSCIOUSNESS OF SPACE AND TIME.\*

F. PARK LEWIS, M.D.

BUFFALO, N. Y.

It is the usual custom in opening the Annual Session of each of the two sections of the Academy, to consider somewhat in detail the advances which have been made in practice during the past year, with special emphasis on those features which seem to be most important or most striking. In ophthalmology, while there has been normal development, the year has been characterized by no discoveries of extraordinary value and the means for bringing to the practitioner the latest observations and experiences of his colleagues from all parts of the civilized world have been so perfected, that the necessity for collating them on such an occasion as this has almost ceased to exist. Moreover, since the opening address has been delivered by the President, it would be an abuse of privilege for the Vice-President to speak other than briefly on matters that concern the interest of the Academy.

In considering the present possibilities of usefulness of our organization and its opportunities for future valuable work, a multitude of interesting ideas immediately suggest themselves. It will be far better, however, and much more practical, if each year, instead of discussing as remote possibilities, the many things that we would like to have done, we set for ourselves certain specific and definite tasks, so that at the end of a determined time, we shall have made actual and appreciable progress in the accomplishment of specific plans.

In harmony with this purpose, I wish to present for your consideration three quite different and disassociated ideas, and if they meet with your approval, it may be thought best to take steps to put them into execution.

The first may be considered administrative. It has to do with the adjustment and arrangement of the results of our daily work, so that they may produce the highest degree of efficiency. The second is social and relates to our responsi-

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\*Vice-President's address.

bilities as the sole members of a community who have knowledge of certain essential facts upon the promulgation of which the welfare, the health and the happiness of our neighbors depend, and of our duty to make known these facts.

The third is scientific and has to do with our share in completing the development of one of the most important of the yet only partially solved problems, but one to which every member of this Academy may contribute, one which is fundamental in regard to all other work which we do—one which may seem to be abstruse, but which is preëminently practical and understandable. It is the physical basis through our sense organs, and more particularly those of sight and hearing, of our position in space and consciousness of time.

#### UNIFORMITY IN RECORDS.

The first has to do with the entire subject of clinical work. It has before this been considered by the Academy, but its successful accomplishment requires the united action of those of our members having important hospital appointments. While it concerns us no more than it does all other practitioners, we perhaps more than others feel the necessity for and could better realize the value of uniformity in method of making our clinical records.

The ophthalmologist of all physicians has always been the most exact. Our visual tools are reduced to metrical dimensions, and our case notes are made with painstaking accuracy. Individually much time and care are expended in recording our observations; and if after many years we wish to seek the data concerning any particular patient, we have no difficulty in a majority of cases in obtaining it. But if, on the other hand, we wish to aggregate the records concerning a certain group of cases of like character, in order that results may be compared or that they may be utilized for publication—and it is only from such groups that any really warrantable conclusions may be drawn—the task is one of such difficulty that it is usually given up as hopeless, and our vast storehouses filled with records of incalculable value are as useless to us, because of their inaccessibility, as though they had never been made. "The characteristics which records should possess," says Mr. Harrington Emerson, whose work in efficiency is as valuable to us as it is to the man of business or to the public corporation, "are that they should be accurate,

complete, specific and *available*." There is a grain of comfort for us in the fact asserted by this eminent engineer that simple as are these requirements, they are only now beginning to be achieved by our great businesses.

When they are complete they are not always accurate. They are often elaborate while lacking the *one item* of information that would make them valuable—and it rarely happens that they are readily available, that is to say, that facts which they contain may be quickly and easily secured. Our modern system of card index makes it possible that without the expenditure of much time on the part of the physician, all of these features may be obtained. It is required simply that a uniformity of system of record making may be inaugurated and generally adopted. This is in line with and as important as our uniformity which we have already secured in test types, in lens measures, and in nomenclature. It must precede any large and important utilization of our carefully made daily observations. It would not only make possible results of inestimable value for the whole profession, but it would serve as a standard by which to determine our individual progress. It would necessitate greater accuracy in our own investigations and would enable us to determine whether certain methods which we were following were producing the highest average of results. And, if not, would warn much sooner than would the vague impression of our memory, of the necessity of changing them; while if aggregated, think of the wealth of material that would be at our disposal if the vast eye clinics of New York, Philadelphia, Boston, Chicago, Baltimore and other great centers could be summarized and put at the disposition of the profession.

Think of the number of operations, necessarily experimental, that would be rendered necessary if from fifty clinics the result of a new and widely heralded operation, be it what it may, were shown to be unfavorable. We would save all the young operators thereby from results which are equally detrimental to the patient and to their own future success. We should find out promptly when certain infections were more prevalent, and where, perhaps, they have their origin. In a search for rare or for exceptional conditions, which are often the key to important facts, the student would have at his disposal the observations of all of his colleagues without the sometimes embarrassing necessity of asking them to take



valuable time in studying their old records and aggregating their results for his convenience.

What would not be its importance, if in that way we might secure accurate knowledge of the late visual results of the La Grange operation, or the ultimate acuity obtained from the early correction of squint in young children? It would give us, after a few months, results which we now get only after years and with greater certitude of accuracy. Such a method is already in existence in the clinic of the Rothschild Ophthalmic Hospital in Paris, as doubtless it is in other well ordered institutions. It is obtained by a systematic card index, in which the various diseases are catalogued under their appropriate headings and sub-headings, with such references in each case to the regular records in which the full detailed notes can be found. It is only necessary under such circumstances to refer to this index to be able to determine in an exceedingly short time how many cases of senile cataract were operated on during the year, which operation was performed, what accidents may have occurred, what the incidental conditions of the patients were found to be, the exact amount of vision obtained in each case after careful refraction, and the condition of these same patients one, two, three years after the operation.

We have as yet no uniformity of method by which scattered observations may be brought together. Would it not be of great practical value if the wealth of material now locked up in inaccessible records were opened to the profession. This could be accomplished simply, easily and probably inexpensively by a uniformity of method, a central clearing house and an open door.

If, for example, any line of investigation were to be undertaken for a specified affection of the eyes, or the results of any special method of treatment or the ratio of the frequency of the manifestations of unusual forms of disease with any peculiar symptoms which they might present, or the incidence and local origin of new cases of such a public menace as trachoma, the benefit of such coöperative labors, if systematically and uniformly conducted when analyzed and summarized, would be of immeasurable value.

I would suggest that a committee representing our largest clinics be appointed with a view to securing some such uniformity in record making, with, if possible, a systematic pre-

sentation of adequate details. If these were to appear in the annual reports of our ophthalmic hospitals and dispensaries, it would make these publications, which are now practically of no public value whatever, one of the most important sources of scientifically recorded fact.

#### PREVENTIVE MEASURES IN OPHTHALMOLOGY.

The second, which surely has important bearing, is our responsibility as ophthalmologists for the absolute control of ophthalmia neonatorum. From the beginning this Academy has stood strongly in support of this important movement. The machinery for effective work has now been so fully perfected that it needs but to be used to effect a complete control of this still existent cause of blindness in almost every community. The methods that have been so successfully employed in many of the states are not of necessity the only ones, nor for all parts of the country possibly the best that could be used. The health authorities in nearly every state are now fully impressed with the importance of saving new born babies from blindness, and are prepared to take official action on the initiative of ophthalmologists whom they know and in whom they have confidence.

The essence of the matter is publicity. Silence is no longer justifiable. It is grossly unfair that a human being should be groping through life because we hesitate to discuss a public evil and a public danger. The department of health must proclaim as they would the existence of smallpox—an infinitely less imminent danger by the way—that the effects of gonorrhea are not transitory; that marriage while the gonococcus exists in the genital tract of either parent is a crime that will demand ultimately the surgeon for the mother, and that it makes babies blind, BUT that it is curable; that infections from this cause may be prevented in the eyes of the infant; that early, prompt, intelligent, persistent, if possible hospital care, should be secured when ophthalmia neonatorum develops, if the eyes are to be saved; that prophylaxis and, if necessary, treatment should be provided by the state as an economic necessity on the part of the state; that ophthalmia neonatorum be made a reportable disease, and that such reports, whether in the practice of the physician or midwife, be insisted upon.

All of these things the authorities are prepared to do. The American Association for the Conservation of Vision will loan exhibits, photographs, lantern slides, etc., to enable a campaign of publicity to be carried out in any part of the country. Would it not be well for the Academy now to hasten the progress of this movement by the appointment of a committee in each state to work with other organized bodies to secure this end? Were this effectively done, this wretched pest which has been the cause of such untold misery could, as it must, be wiped off the face of the earth.

This, it may be remarked in passing, is of course only one of numerous conditions which, were proper sanitation observed, need never result in disaster to the eyes. All modern thought is being directed to the study of problems in conservation. When it is evident, therefore, that we are prodigally destroying eyes in our schools which ought to be saved, our interest as ophthalmologists is at once aroused. The unwisdom must appeal to every one of us of school regulations which compel myopic children to go through the same curriculum and under the same conditions as those followed by other children with strong and normal eyes. The compulsory educational laws require that these children shall regularly go to school, though the continued use of their eyes under the condition which the school demands means in many cases that their eyes must be sacrificed. The absurdity of allowing such conditions to continue is self-evident. It should be immediately stopped.

Already in New York special classes for such children have been established. It is evident that they should be provided in every school for those children in whom close work is inimical to the integrity of the eyes. Numerous instances of like character could be pointed out in which proper ocular hygiene or proper preventive measures would save eyes from defects which lower the efficiency of the individual or which may result in blindness. The necessity of ophthalmologists everywhere identifying themselves with movements looking toward the conservation of vision is becoming more and more apparent.

#### THE PHYSICAL BASIS OF OUR CONSCIOUSNESS OF SPACE AND TIME.

The third point which may be worthy of our consideration has to do directly with the scientific work of our Academy. The labors of any individual, no matter how carefully they

may be conducted, are of less value than the combined efforts of many. This is especially true if the problem to be solved is one which may be approached from many sides. If the efforts of a large number of persons were directed for even a limited time to the investigation and observation of important but doubtful conditions, facts would be obtained which would be of immense scientific value. Retrospective notes are rarely as valuable as those which are taken with a specific object in view. If then all of the members of the Academy were to direct their attention during the coming year to the clarifying of one obscure point, it might enable us to add to the sum of accumulated knowledge a fact of basic importance.

Happily, more recent investigations have emphasized the need of more exact information concerning an area of the brain of which clinically we have known but little, but to the physiologist and the psychologist is of the deepest importance, while the function which it is found to control have for the metaphysician and the philosopher the deepest interest.

It is an area which concerns equally the otologist and the ophthalmologist, because it involves that portion of the brain in which psychically the functions of the eye and of the ear are united, in giving us a consciousness of our position in space and of our relation to time.

From the time of the classical experiments of Flourens we have known that the labyrinth governed our equilibration, but it required the carefully conducted experiments of his then young associate, Elie de Cyon, through a long period of years, to prove that the semi-circular canals are the peripheral organs of space; that from their position, horizontal, vertical and sagittal, we have an idealistic conception of the three properties of matter, length, breadth and thickness; that this ideal conception is made actual and real by the added experience of vision and touch, and he constrains us to believe with him that it is to the synthesized psychic impression produced by the joint action of the waves of sound and of light that the geometry of Euclid and that the science of numbers are made comprehensible to human intelligence.

Only during the last few years have the investigations and reasoning of this most judicious observer, which had been published in Pflügers Archives and elsewhere, been aggregated in available form, but in 1908 Springer, in Berlin, pub-

lished "Das Ohrlabyrinth als Organ der Mathematischen Sinne für Raum und Zeit," which was anatomical; in 1910 Felix Alcon of Paris his "Dieu et Science," which is philosophical, and during the present year "l'Oreille," which is physiological, and the minute investigations, the careful analyses of findings, and the judicial reasoning of this master scientist have taken the subject of our consciousness of space and time out of the domain of the metaphysician and put the responsibility for its development clearly in the hands of the anatomist, the physiologist, the psychologist and the *clinician*.

Most important, therefore, are his experiments with animals having but the two semi-circular canals and living; therefore, in two dimensional spaces like the lampreys or those with but a single semi-circular canal, the saggital, like the dancing mice of Japan, which maintain a constant whirling motion, and in which the investigations of Rawitz have shown that this lack of ability to proceed in a straight line is the result of degenerative labyrinthine changes.

Very recently Professor Ehrlich has succeeded in artificially producing whirling mice by injections of arsacetin. The investigations subsequently made by Paul Röthig in Edinger's laboratory showed marked degeneration of the *vestibular nerve* and of the optic tract.

Less pronounced was degeneration of the cells of the nucleus of Deiters and of the nucleus of the acousticus properly so called. The degeneration of the optic tract appeared much later than that of the vestibular nerve. In his second communication Röthig directed attention to the analogy to the blindness which has sometimes followed the administration of atoxyl in man, to the degeneration in the optic tract subsequent upon the injection of arsacetin, and strengthens the impression that the localized neuritis is due to the action of the drug, and not as Ehrlich contends, that is, simply a later manifestation of syphilis.

But I must emphasize the fact that almost all of these important observations have been made in the laboratories of the physiologist and the pathologist, that the reasoning upon which such vital conclusions depend is that of the psychologist and of the philosopher, while the *clinician*, to whom this field is of the highest practical value, has scarcely touched upon its outer edge.



If it be true, and it has been practically demonstrated that it is, that as it is the harmonious blending of the psychic impressions which come from the sense of hearing and from that of sight that we maintain our equilibrium and spacial sense, it naturally follows that a disassociation of this adjustment will disturb our relationship to our surroundings, and will produce a tendency toward those conditions which would exist if this inhibitory control were not maintained, such as pallor, lack of muscular control, together with a dulness of the sense of hearing and frequently a tinnitus or sense of stuffiness in the ears. This may be produced temporarily by a rapid rotation as in a swing, looking from a height, or any movement to which the eyes are unable rapidly to adjust themselves. It must follow that in an anisometropia or in astigmatism in which there is asymetry of the angles or ciliary fatigue, it will make difficult or impossible the blending of images which must psychically synchronize with the labyrinthine impressions to give us our proper spacial relationships. Failing this, we have these conditions which, as I demonstrated before this Academy three years ago, constitute the precise symptom complex which is known as Menier's disease.

That the eyes may produce symptoms involving the ears was illustrated many years ago by a case reported by Stevens. A series followed by Broughton, while almost simultaneously but each unconscious of the work of the other, Rollett in France, Ryerson in Canada, and Theobald and myself in this country, demonstrated clinically that this reciprocal relationship was by no means unfrequent. This was substantiated in a discussion by Risley before the American Medical Association in 1909.

It is evident that an element exists in this connection which has heretofore been overlooked, even by so careful an investigator as de Cyon, that when abnormalities or dissimilarities, structural or functional, exist in the eyes, through whose harmonious action we have stereoscopic vision, or the ears by which we become conscious of the actual existence in space of things that we see, that this disassociation of physical impressions necessarily produces psychic disharmonies, manifested by a wide variety of physical disturbances and manifestations, which have an important bearing not only upon the psychology and physiology of every human being, but from

the physiological conditions involved, give us a reasonable and scientific basis in explanation of our orientation in space, and aid in the solution of one of the most important problems in the philosophy of the universe. The verification of this may be found on every side. We need simply to look for them from the standpoint of the practical clinician to gather them together and to arrange them systematically to realize their importance.

With what could our Academy more profitably concern itself during the coming year than to supplement the work that the physiologist, the psychologist, the neurologist, the mathematician and the philosopher, the comparative anatomist and physicist are doing in the study of this important field, thereby adding clinical demonstrations which would be of even greater value and more fundamental importance than that of the others.

## AUTO-TOXÆMIA IN OPHTHALMIC SURGERY.\*

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There is no more interesting feature in our social structure than a great clinic. Established and maintained by the philanthropic spirit of a community for the benefit of the afflicted and dependent poor, it stands at once as a great benevolence and a great school. It is doubtful whether it could have fallen within the concept of a pagan civilization. It is one of the most striking evidences of the essential character and exalted status of the medical profession, as a part of our social fabric, that the clinic would fail in its benevolent intent but for the unselfish coöperation of medical men, the majority of whom spend a large percentage of their lives in the gratuitous care of the poor and unfortunate, either in their homes or at the public clinics. The efficiency of their work at the clinic would be greatly enhanced by a more intimate knowledge of the conditions under which the average clinic patient lives. I am fortunate in having spent my first three years in practice as a visiting physician for the Northern Dispensary of Philadelphia. The district assigned to me was largely inhabited by the "submerged increment," a circling eddy beside the onflowing tide of life in a great city, a sargasso sea peopled by human derelicts. For three years a large part of every day and of many nights was passed in this semi-stagnant pool. Who that has had such experience can ever forget the crowded dwellings, the neglected decencies, the filth, the malodorous patient and sick room, the parturient mother, already surrounded by a brood of unfortunates; the sick, indolent or drunken husband; the unfailing generosity and kindness of the equally unfortunate and helpless neighbors in poverty and distress. How true the old saying that "half the world does not know how the other half lives."

The surgeon should not forget that in every great city clinic a considerable percentage of the patients applying for treatment come from these infected and infecting eddies of population, reeking with the odors from soiled clothing, unwashed

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\*Read by invitation.

bodies, blocked-up skins, infected alimentary tracts and diseased mucous membranes. To admit them to the wards of the hospital without adequate precaution is fraught with peril to others; to prescribe drugs which they are too poor to purchase, or to administer medicines which cannot cure their degeneration, which is their disease, is useless. The cases are not rare before whom the hospital surgeon must feel a sense of helplessness because of the complex social problems which must first be solved before he can be helpful. I have drawn briefly this sketch of the life and conditions of clinic patient as a suggestive background for the many features of the surgeon's work which it is necessary for him to see and consider his daily routine, which if neglected thwart his best endeavors. Very early in my career I was impressed by the relatively better results secured in private than in hospital practice, notwithstanding the fact that the latter was done under a better sanitary equipment. I believe the explanation is found in the unsanitary condition of the hospital patient.

The careless habits, the unsanitary dwellings, and the gross, uncleanly and improperly prepared food favor the cultivation of an abundant intestinal flora which, together with their toxic products, are doubtless the origin not only of many unclassified forms of general ill health, incipient cardio-vascular disease, etc., but of the so-called endogenous infections which so frequently undo the work of the surgeon in spite of local antiseptic surgical precautions. In addition to these considerations we must remember that the chronically diseased nasopharynx and contiguous sinuses so common among these people, and their universally neglected oral cavity, with ulcerated gums, stumps of decaying teeth and necrotic alveoli, furnish a most fruitful source of local infection of the conjunctiva, and may often be the origin of suppurative disease of the cornea and infection of wounds after operation. The fact that convalescence is so frequently uneventful until the dressings are removed after the extraction of cataract, e. g., is suggestive. The condition of the mouth and naso-pharynx in which microbic colonies revel undisturbed, renders it almost certain that these infecting bodies are sprayed from the mouth and nostrils into the atmosphere of the ward and are carried by the fingers of the patient to the bedding and dressings, and thence to the eye after the bandage is removed. It is obviously important, therefore, that the first care of the sur-

geon should be to improve the sanitary conditions of the hospital patient before undertaking any operative interference, and that not the least important of these is the cleansing of the nostrils, mouth and pharynx. The freeing of the alimentary tract of noxious contents by free purgation is probably a matter of routine practice with every surgeon. Personally I administer calomel and soda, 1 gr., in divided doses, to be followed by sulphate of magnesia at least twenty-four hours before undertaking any surgical interference involving the opening of the eyeball.

The extraction of cataract, for many reasons, must always remain a capital procedure to the ophthalmic surgeon. I sometimes feel that we pay too much attention to matters of technique in operative procedure and too little to the etiology of cataract and to the general condition of the patient. It is probable that this has grown mainly out of two factors. First, because of the essential difficulties of the operation, a fact the appreciation of which grows with increasing experience. Second, that the qualifying term "*senile*" cataract in our nosology has called attention from a due consideration of the underlying pathologic factors in the etiology of opacity of the lens, thereby leading the surgeon to regard it as one of the necessary concomitants of age, whereas cataract is an exceptional occurrence, even in very old people. It is obvious, therefore, that there must be some other cause than advancing years.

I do not wish to minify the importance of a carefully chosen procedure and an accurate technique in operation for the extraction of cataract, since failure is often due to faulty judgment in the choice of procedure or to a faulty technique. I wish simply to urge that there is probably no form of ocular disease in which a careful study and the thoughtful management of associated systemic conditions is of greater value than in old people afflicted with opacity of the lens. In 1889, after a painstaking statistical study of my own experience up to that time, I prepared a paper on "The Etiology and Management of Incipient Cataract." Additional experience has served only to emphasize the views then, I believe, first put into the literature of this important subject. The contention was that the term "*senile*" should be eliminated from our nosology and all opacities of the lens regarded as pathological. That is to say, that all eyes in which cataract occurs, were to



be regarded as pathological eyes and treated accordingly; that when seen in the incipient stage the opacity of the lens was usually associated with chorioidal disease, vitreous changes and other symptoms of impaired nutrition of the ball; that suitable treatment at this stage often arrested its progress; that if the opacity progressed in spite of treatment, or, when first seen was too far advanced to hope for its arrest, the health of the ball was so far improved by treatment as to render the prognosis from operation more hopeful. During the intervening years my advice to all cataract patients has been based upon the conclusions then formulated. The treatment to be adopted is guided by a study of the etiological factors of the chorioiditis.

A routine study of all cases of incipient cataract reveals with a somewhat surprising frequency a group of significant objective and subjective phenomena. Among these, in the symptom complex, will be discovered in many cases a history of asthenopia which may have disappeared with the physiologic loss of accommodation and forgotten by the patient, being elicited only by careful inquiry. The fundus will show the scars resulting from years of eye strain due to some uncorrected anomaly of refraction or binocular balance. But what is of more significance in our present study of the signs of the wear and tear of life which first present themselves during and after middle life. The old aphorism that "a man is no older than his arteries" has certainly lost none of its practical significance through the improved and more elaborate methods of modern research. We are now able, in some measure at least, to detect the incipient stages of blood vessel disease, and although our knowledge is incomplete, we understand somewhat the underlying causes and the rational methods which should be adopted for its arrest, and the prolongation of life.

The study of syphilis since the discovery of the spirillum by Schaudinn and Hauffman in 1905 has thrown a flood of light upon the probable pathological processes in many other forms of disease. The infecting agent in that disease entering the tissues by the doorway of the epithelium is carried by the blood and lymph streams throughout the organism, finding lodgment in various organs; showing especial proneness to attack the walls of the blood vessels and to form foci of infection in other structures developed embryonically from the

ectoderm and mesoderm. The ophthalmologist especially is constantly called upon to witness the proneness in the specific diseases of the uveal tract, as in iritis and irido-chorioiditis. Much of the same may be said, with variation as to details, of tuberculosis, influenza and the exanthemata, especially measles. While our knowledge is less complete than in the case of syphilis, clinical analogues seem to make it probable that many obscure forms of disease may in like manner be explained by microbic infections originating in the alimentary tract.

Metchnikoff has ascribed the relatively shorter life of those mammals having a larger colon than that of other vertebrates, to the retention in the colon of waste products for considerable periods of time, which become the nidus for an abundant intestinal flora which through absorption, either of the microbes or their toxins, become harmful to the organism. That this is true of the human species is suggested by clinical observation. A striking example among many others being the phlyctenular ophthalmia of childhood. In this affection local treatment is futile until the uniformly associated alimentary disturbance is corrected by suitable treatment and the control of ingested foods.

Not only diarrhea, but also the diseases of constipation in their symptom complex not infrequently suggest the presence of a general infection. I have elsewhere published a paper on this subject with illustrative examples of eye disease.

The purpose of this seeming digression is to add these intestinal infections to the picture we all have in mind of the lithæmic diathesis and its protean manifestations, but especially as an etiologic factor in cardio-vascular disease. We are not unmindful of the important relation between many forms of eye disease and the rheumatic or gouty diathesis, whatever that may be. The ophthalmoscope has made us familiar with the fundus conditions so often present. The fluffy, even cedematous, condition of the retina and chorioid blurring the borders of the nerve and obscuring all details; the full, dark and often tortuous retinal veins; more or less impaired vision, and in intestinal toxemias, frequently relative or even absolute central scotomata and concentric narrowing of the field of vision. In addition to these there may be absorption splotches in the fundus suggesting succeeding patches of chorioiditis or hemorrhages. If the process has been a

more or less chronic one, the vitreous will be filled with a granular infiltrate or with opacities floating freely in a more or less fluid, degenerating vitreous, and there will be banks or spicules of opacity in the periphery of the lens, and a gray posterior capsule with beginning posterior polar opacity, which, if neglected, passes rapidly into ripe cataract.

In hospital practice advice is sought, in many cases, only after one eye is blind from opacity of the lens and vision failing in the second. It is reasonable to conclude that the conditions which have already been briefly described, and which it is still possible to study in the better eye, are still present and of a more virulent character in the already blind eye. Operation upon such an eye should be undertaken, if at all, only after a grave prognosis, even when we consider the local conditions alone. The picture I have drawn is not a rare one at the Wills Hospital. Its gravity, however, by no means ends with the local disease. A study of systemic conditions reveals not only the cause of the blurred œdematous fundus, full veins and chorioidal splashes, but explains the accidents of convalescence following operation upon such eyes. The impaired health, high tension pulse, the traces of albumin and the presence of indican in a urine of high specific gravity and a blood pressure often as high as 200 mm. of mercury are not promising conditions under which to undertake so serious an operation as the extraction of a hard cataract, which, when all is said, is secondary to the disease of the fundus oculi, and the retino-chorioidal affection only one of the local manifestations of the general cardio-vascular disease. The eyes have suffered only in common with the kidneys and other organs of the body and need the ministrations of a surgeon who is first and foremost a wise physician. It is not my contention that all cataracts are of this type, but many of them are, and in a majority of all cases of hard cataract the opacity of the lens has occurred because of the impaired nutrition of the eyeball, brought about either through purely local disease of the uveal tract due to eye strain; or to affections of the contiguous sinuses, or by chorioidal disease produced by some general dyscrasia or some specific infection or auto-toxemia.

These considerations are sufficient to explain many of the disappointments and disasters which follow the wisest surgical procedure and the most painstaking technique. The attacks

of iritis or irido-cyclitis occurring on the fifth to the seventh day, sometimes acute, more frequently painless, but attended by increasing redness, photophobia, tenderness of the ball and prolonged convalescence usually belong to this group of patients. There is gluing of the iris to the capsule which becomes daily more tough and opaque; and even after successful secondaries there is impaired acuity of vision, due to infiltration of the vitreous or even to streamers of lymph stretching across the vitreous chamber. In bad cases, we are compelled to witness recurring hemorrhages into the anterior chamber, the steadily contracting pupil, which is drawn upward, and final failure to secure useful vision. Who has not had this experience? I believe that they are often explained by the conditions I have described as preceding the occurrence of the cataract and to which the opacity of the lens is only one of the secondary phenomena. When we call to mind the anatomical fact that the lens and vitreous are avascular structures, receiving their nutritive pabulum at second hand from the vascular choroid, it is to be anticipated that they would be the first to suffer from any impairment of function in that membrane.

The picture I have so briefly sketched in outline is one which I have for many years had abundant opportunity to study in my cataract beds at the Wills Hospital, and have found that it is far better to defer operation until the alimentary canal is freed of its microbe and toxic contents, the urine of normal specific gravity and free from indican, albumin and excessive acidity and the blood pressure approximately normal. It is gratifying and instructive to witness how rapidly this will be secured under the daily or tri-weekly administration of sulphate of magnesia or some of the other soluble alkaline earths. My favorite is the chloride of calcium in 5 gr. doses three or four times daily. This salt seems to enter rapidly the tissues and blood streams, probably correcting the hyperacidity. If the blood pressure is high, nitroglycerine is useful. Until these systemic conditions are corrected operation should be deferred. It is possible that in those fortunate communities away from the stress and turmoil of a great city these cases may not be so numerous. Their analogue in private practice is furnished by women after middle life who have passed through the stress of the social whirl; or by men worn to the breaking point by the anxieties and responsibili-

ties of great business enterprises or by the physiologic vices inseparable from dissolute living.

What has been said regarding the history and essential nature of a large group of cataract patients is also true for the patients afflicted with inflammatory glaucoma. I have, with many others, written so frequently of this as a local manifestation of cardio-vascular disease, that it seems unnecessary to dwell upon it in the brief time allotted to the presentation of papers. But increasing experience serves only to emphasize the gravity of this disease. In its worst phase, that of hemorrhagic glaucoma, we all know that its hopelessness grows out of the fact that the arterial disease is already so far advanced as to promise a speedily fatal result.

#### DISCUSSION.

DR. WENDELL REBER, Philadelphia:—I am sure you all feel, as I do, that it has been a privilege to listen to this paper from one who has been a great clinical teacher for thirty years in Philadelphia. I should not have wanted to miss any portion of it, and I find myself instructed just as much in Indianapolis by Dr. Risley as I have been in times gone by in Philadelphia. Anyone who has had the advantage of such a tremendous clinical experience in the past thirty years, as has had Dr. Risley, must come away from the study of this subject with just such conclusions as he has given us. He has been one of the exponents of the value of preparatory treatment before the operation for cataract, and that at a time when his views were held almost in derision. The earlier authorities always spoke of choroidal cataract; it is allowed a place in all our text books, and seems to be reserved for those cases where the lenticular condition was secondary to choroidal disease. But I think the profession is indebted to Dr. Risley for having driven home the fact that the majority of cataracts in old people are, in a sense, choroidal cataracts. I mean in the sense that the average cataractous eye is a sick eye. If the patient's metabolism were right and normal for their time of life, in all probability they would not develop cataract. It would then follow in this sense that most senile cataracts are secondary cataracts. The "good" senile cataracts that the old authors talked of were the cases that would get well, no matter under what conditions, or by whom operated—the cases that are the delight of everyone. What a great name—the "good senile cataract!" There are people that seem to grow old physiologically, without presenting much abnormality, who do develop cataract, but I think they are comparatively rare. My own observation makes it seem to me that the dicta Dr. Risley has laid down here will hold good for the whole country, for it is the outgrowth of our life conditions, the things he so beautifully calls "physiological vices." I am much indebted to him for that phrase.

As to the preparatory local treatment, we are all familiar with the work of numerous investigators—the washing off of infection through the canaliculi, and flushing out the nasal passages with permanganate of potassium. I agree with the speaker that the best possible condition of the patient, as also of his or her nose and its sinuses, are conditions which predispose to good, kindly healing.



As to internal treatment for two to four weeks prior to the cataract operation, I think he has left nothing to be said. Calomel is a gift of the gods. Its effect should be prolonged in the vast majority of cases, by protiodid or biniodid of mercury. The things we are doing is to raise the vital forces of the person who shows plainly that their vital resistance is below the normal healing point.

My first paper before this Academy was on the subject of cardio-vascular disease and the expression of general cardio-vascular disease as reflected in the retina, and as related particularly to glaucoma. I think there are very few of these cases that will not exhibit by indican conjugate sulphates or other evidences that they are the subject of improper elimination. During the last four years where I have had desperate conditions to deal with, indicating almost certain infection, I have instilled 20 per cent argyrol into the conjunctival sac, and I never have seen infection following operation. I have a feeling of deep personal obligation to Dr. Henry Dickson Bruns of New Orleans, La., for this suggestion.

DR. LUCIEN HOWE, Buffalo:—I hesitate to venture a word so early in the meetings. But I could not help seconding what has been said in praise of the paper. I would also call attention to one point which was not mentioned. This is in regard to the change which takes place in the lens, and was first mentioned, I think, by Schoen of Leipzig. If we make a section through a lens which has a few opaque striæ, the fibres of the ciliary muscle are most frequently at the points at which the lens begin to be opaque. This seems to show a connection between the ciliary muscles and the opacity of the lens.

DR. J. A. STUCKY, Lexington, Ky.:—I rise to emphasize one point; the contention of Dr. Risley as to stomach conditions and faulty metabolism is just as true in regard to the ear, nose and throat. Dr. Risley's paper emphasizes very clearly the duty of this Academy, the duty of the entire medical profession, to enter a campaign of education to prevent so many of the diseases that we have to contend with today. I believe too many people have choroiditis. So do you. I believe too many people have diseases of the conjunctiva. So do you. I believe too many people have cataract. So do you. These diseases are not always of specific infection, but are very frequently the result of a systemic condition which disturbs or impairs metabolism, and I am glad that Dr. Risley has emphasized a point I made in a paper I read seven years ago in regard to the lithemic condition in relation to nasal trouble. The question is primarily one as to the condition of the alimentary canal. It is not the sugar or albumin in the urine that causes me so much concern as the indican; and, the blotchy skin and diseased conjunctiva are the efforts on the part of nature to do what the alimentary canal, the skin and other eliminative organs, etc., have failed to do.

DR. F. PARK LEWIS, Buffalo:—This is one of the most valuable contributions that the Academy has received. It emphasizes as has not been done before, for a long time, the imperative necessity of the specialist being, first and before everything, a physician. We can no longer effect the best results by following narrow lines. It is the advance thought of the time that in every line of investigation we must go down to the bottom of things—to find why things exist that do exist. It is very clear to those of us who do clinical work that many of the cases that come to us would never reach us at all had conditions of the right living

been followed in the life of the individual, disease would never have developed. As practical men we ought to know what can be done to better these conditions. The most essential factor, it seems to me, is the necessity of co-ordinating our work with that of the social workers in the city life. It is not alone in America that these limitations exist, I have seen busy men in the clinics of Paris, whose time was of great value, trying to clear conditions by local measures when they should have struck at their origin in the home. Cases, which had been referred to the social worker, would have been bettered by improved hygiene. It would release so much of the time now used in the clinics that the physician would be able to give the necessary careful study to the more obscure cases which need special investigation.

The paper is full of suggestiveness, and I will only emphasize this one point that we must consider social service as an essential part of our dispensary work if we expect to get the largest results with the least expenditure of time, energy and money.

DR. DERRICK T. VAIL, Cincinnati:—I would like to add my hearty approval of Dr. Risley's paper and of the discussion. Dr. Risley's teachings have certainly resulted in very great good. Reber and his other distinguished pupils who have profited by his teachings have carried on a campaign of education in such a way that the profession is beginning now to fully appreciate the relation between the diseases of the eye, more particularly cataract and abnormal systemic states, than was ever before appreciated.

I rose to say that the title of the paper, "A Year's Experience in Will's Eye Hospital, Philadelphia," is rather unfortunate and should be changed. Students who are investigating the subject of the relation between cataract and general disease would fail to find this valuable paper if published under the title announced on the program. Dr. Jackson, one of our members, has recently entered a protest against essayists announcing the titles of papers which do not indicate what the contents are. I think if Dr. Risley would consider another title it would add great value to his paper as a matter of reference, and I would suggest a title such as "Etiology of Cataract," "Chronic Systematic Infections in Relation to Cataract" or something of that sort.

DR. E. J. BERNSTEIN, Kalamazoo, Mich.:—Regarding the treatment of cataract other than surgical—preventive, etc., I have had some experience in the line of treatment of cataract along non-surgical lines; true it is that it does not cover very many cases, and I give my views now in a very tentative way. I have been trying to treat my early cases, when vision is only slightly impaired, by attention to the general health, looking after nasal cavities for any lesion there and giving a very mild—1/5 per cent atropin oint. to be used once daily. I have thought in some eight or nine cases that I have gotten a great deal of benefit from the subconjunctival injection of dionin, beginning with a 1 per cent solution, then gradually increasing to 5 per cent, three times a week. I am now treating two cases along these lines; three cases showed no result. I should add, that although vision was greatly improved, the ophthalmoscope did not show any marked difference from what was seen at the first examination.

DR. S. D. RISLEY (closing discussion):—Dr. Risley in closing the discussion wished to express his gratification over the very generous way in which the fellows of the Academy had received his paper and to thank those who had participated in its discussion. The paper was not

the one promised in the program, which was to be an analysis of a year's surgical work in his clinic at the Will's Hospital. He, therefore, would follow Dr. Vail's suggestion and change the title. He was pleased that his friend Dr. Lewis had seen the important sociologic features of the subject as discussed in the paper.

Dr. Risley had elsewhere urged that our great schools should have a chair devoted to sociological medicine, from which the ethical and sociologic relations of the profession to the community should be taught. Inquiry had been made regarding the methods, simply alluded to in the paper, of treating incipient cataract locally. Careful study of eyes with commencing opacity of the lens he said would reveal a group of important symptoms. There was headache, or a history of headache in the past; the caruncles were swollen, the conjunctiva injected, the eye irritable. The ophthalmoscope revealed a fluffy fundus, a honeycombed chorioid; in toxemias very often dull and tortuous veins and impaired fields of vision; the vitreous hazy and often filled with a granular infiltrate or web-like opacities floating in a fluid, degenerating vitreous. In conjunction with systemic treatment, for example due attention to the alimentary tract, diet, etc., iodides of iron or other required medication, he invariably employed locally some alkaline antiseptic conjunctival wash and a mydriatic, preferably a solution of homatropine three times daily. The eyes were protected from strong light by smoked glasses and complete rest from all work required.

It was gratifying to note how rapidly the subjective symptoms subside; the vitreous and chorioid conditions improve and the acuity of vision increases. Not infrequently he had observed the hazy, even swollen lens become more transparent. After a few weeks it became possible to select correcting glasses. He had constantly under observation a large group of such patients, many of whom had been followed for many years without any increase in the opacity of the lens; patients to whom in former years he would have said, "Yes, you have commencing cataract—but they are not ripe. When they are sufficiently advanced they can be removed and you will see again." He did not wish at this point, however, to be misunderstood. He had never seen opaque spicules or opacity of the capsule or cortex at the posterior pole disappear. He did not believe that they ever did disappear, but wished to urge that, as the chorioid disease improved under suitable treatment, the general nutrition of the globe became better, the nutrition of the avascular lens and vitreous also improved and the cataract did not advance. Dr. Savage inquired, did he use mydriatics in old people. Yes, without hesitation, provided only that there was no evidence of increased tension or other signs of *glaucoma imminens*. It would be unwise, or worse, to use a mydriatic in such cases. He had never allowed the *age* of any person to influence him in the employment of the mydriatics and had used them with impunity in many thousand of eyes in patients beyond fifty years of age. It was to be understood that in these old people with incipient cataract it was not employed either as a cycloplegic or for mydriasis but for its soothing therapeutic influence.

Do I do simple extractions? Yes, but only in gray white cataracts, where the pupil dilates widely, which was to be accepted as an indication that the uveal tract was relatively healthy; but, in amber colored lenses and a narrow pupil? No, for, in such cases, the prognosis for any operative procedure was not as good because of pathologic conditions in the uveal tract.

# ON THE NATURE, CAUSE AND RELIEF OF GLAUCOMA.\*

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## I. INTRODUCTION.

The amount of water held by tissues under various physiological and pathological conditions is, as is well known, a variable one.† If we ignore certain vitalistic conceptions (which "explain" nothing) there exist only two theories which try to account for the variations in the amount of water held by a tissue that have a physical or a physico-chemical basis. The first of these has to do with the pressure of circulating liquids, and is one which has met with particular favor in the eyes of those physiologists and pathologists whose aspect of biological problems has been greatly influenced by their interest in the vertebrate. Through the influence of an increased blood or lymphatic pressure it has, for example, been believed possible to account for the increased amount of liquid held by tissue in a state of oedema. The second, or osmotic theory, has been particular acceptable to "general" physiologists, that is to say, those whose interest has centered more in a physiology and pathology which is common to all cells than in the physiology and pathology exhibited by definite organs, or specific animal systems. Both animal and plant biologists found common ground when for the pressure of circulating liquids (which are possessed only by certain animals and which can play no role in such as do not possess

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\*Read by invitation.

†This paper is taken in large part from the author's previous discussions of this subject published elsewhere. For papers that deal specifically with the problem of Glaucoma see Martin H. Fischer: *Journal of the American Medical Association*, 1908, LI, 830; *Pfluger's Archiv*, 1908, CXXV, 396; *ibid.*, 1909, CXXVII, 1; Hayward G. Thomas and Martin H. Fischer, *Annals of Ophthalmology*, 1910, January; Hayward G. Thomas: *Journal of Ophthalmology and Oto-Laryngology*, 1911, July. For discussions of the general problem of water absorption by the tissues under physiological and pathological conditions on colloid-chemical grounds see my *Physiology of Alimentation*, New York, 1907, 182-187 and 267-269; Martin H. Fischer and Gertrude Moore; *American Journal of Physiology*, 1907, XX, 330; *Kolloid Zeitschrift*, 1909, V, 286; Martin H. Fischer: *Pfluger's Archiv*, 1908, CXXIV, 69; *ibid.*, 1908, CXXV, 99; *ibid.*, 1909, CXXVII, 46; *Kolloid Zeitschrift*, 1909, V, 146; *ibid.*, 1909, V, 197. A running account of these various ideas is found in my monographs *Oedema* (John Wiley & Sons, New York, 1910) and *Nephritis* (John Wiley & Sons, New York, 1911), or in their German translations, respectively by Karl Schorr and Wolfgang Ostwald, and Hans Handovsky and Wolfgang Ostwald (Theodor Steinkopf, Verlag, Dresden, 1910 and 1911).



them, or in plants) there was substituted the theory of variations in osmotic pressure to account for changes in the amount of water held by cells. By this theory of osmotic pressure which originally promised so much toward an explanation of the problem has, with time and an increase in experimental facts, shown itself less and less capable of accounting for more than a small portion of the phenomena observed in living cells. A part of the objections that have been raised against the biological importance of the osmotic theory have been met through the addition which has been made to our knowledge of the constitution of protoplasm through Overton and Meyer's studies on the lipoids. But even with this advance the major portion of the problem of what determines the absorption and secretion of water by a cell has still been untouched.

Because of the fact that we possess a physico-chemical explanation of only a small portion of those physiological processes which are connected with a storage or a movement of water (turgor in plants, plasmolytic phenomena in animal and vegetable cells, certain phenomena of growth, œdema, glaucoma) it seemed in order to cast about for further physical or physico-chemical forces capable of influencing the migration of water, and of such a character as we might imagine active in living protoplasm. A force which promised from the first to help much toward an explanation of many of the phenomena connected with a migration of water in the animal or vegetable cell was *the variable affinity of the colloids for water*. For not only is the bulk of what we term "living" matter made up of "colloids, but a vast proportion of them belong in that group whose great characteristic is the property of swelling, that is to say into the group of the *hydrophilic colloids*.

The fact that hydrophilic colloids *exist* in the tissues does not, however, prove that it is they which are chiefly concerned in determining the amount of water held by a tissue. This had to be done by experiment. To prove my contention I pointed out the parallelism that exists between the absorption of water by certain colloids and the absorption of water by various tissues. The conditions which Gertrude Moore and I found to govern the swelling of fibrin, for example, are identical with those which govern the swelling of frog's



muscle. A similar parallelism exists in the case of gelatine and muscle. As nothing of the nature of a circulation exists in these experiments the argument that any pressure effects *per se* influence the amount of water held by a muscle is nullified. These experiments on the swelling of fibrin and the swelling of muscle suffice to explain not only the phenomena ordinarily adduced in favor of the osmotic conceptions of water absorption and secretion in the living cell, but also the action of acids and alkalies which have proved most annoying exceptions to the osmotic theory. The experiments, therefore seem to me to prove conclusively that *the state of the colloids is the chief determining factor in the absorption and secretion of water by the tissues.*

## II. OBSERVATION ON THE SWELLING OF FIRBIN.

In order to illustrate what is meant by the absorption of water by colloids and the effect of various external conditions upon this, we will introduce here some simple experiment on the absorption of water by fibrin.

In these experiments ordinary blood fibrin was used, which after having been thoroughly washed to free it from adhering salts, was dried at a low temperature and pulverized in a mortar. When weighed amounts of such powdered fibrin (0.25 gram.) are introduced into definite volumes (25 c. c.) of various solutions contained in test tubes of the same diameter (1.7 cm.), the fibrin swells to very different heights. From the results of many series of experiments, the following facts, which are of importance in our discussion, have been determined.<sup>1</sup>

(a) Fibrin swells more in the solution of any acid than it does in distilled water, but when equinormal acids are compared, the amount of this swelling is bound to be greater in some acids than in others. To mention in particular only a few of a whole series of acids that have been studied, it is found that fibrin swells more in hydrochloric acid than in nitric acid, and more in this than in acetic acid. Even less capable than the last named is sulphuric acid, in whose solution fibrin swells but little more than in distilled water.

<sup>1</sup>See also Martin H. Fischer and Gertrude Moore, *American Journal of Physiology*, 1907, XX, 313; *Kolloid Zeitschrift*, 1909, V, 197; Martin H. Fischer, *Pflüger's Archiv*, 1908, CXXV, 99.

The amount that fibrin swells in any acid solution is dependent upon the concentration of the acid. Within certain limits fibrin swells the more the higher the concentration of the acid.

In the case of the "strong" acids, however, a maximum is attained, above which a further increase in the concentration of the acid does not lead to a greater absorption of water, but to a diminished one. These facts are well brought out in the following table, which may serve as an illustration of the values obtained in such experiments as are being described. In the case of acetic acid it will be noted that the highest concentration of acid used in the table induces the greatest amount of swelling. At concentrations above 1/10 normal I obtained a height up to 41 mm. with this acid. As yet I have not, however, been able to determine if with such a "weak" acid a point is finally reached beyond which, as with the "strong" acids, a further increase in concentration brings about a diminished absorption.

Concentration of the Acid.						Height of the Fibrin Column in mm. After 24 Hours in				
						Hydro- chloric Acid.	Nitric Acid.	Acetic Acid.	Sulphuric Acid.	
1	c.c.	1/10	normal	acid	+ 24	c.c. H <sub>2</sub> O	12	13.5	8.5	8.0
2	c.c.	1/10	normal	acid	+ 23	c.c. H <sub>2</sub> O	23	26.0	10.0	9.0
3	c.c.	1/10	normal	acid	+ 22	c.c. H <sub>2</sub> O	37	29.0	10.5	9.5
4	c.c.	1/10	normal	acid	+ 21	c.c. H <sub>2</sub> O	47	37.5	11.0	10.0
5	c.c.	1/10	normal	acid	+ 20	c.c. H <sub>2</sub> O	48	35.0	12.0	10.0
6	c.c.	1/10	normal	acid	+ 19	c.c. H <sub>2</sub> O	—	30.0	12.0	11.0
7	c.c.	1/10	normal	acid	+ 18	c.c. H <sub>2</sub> O	—	30.0	13.0	11.0
8	c.c.	1/10	normal	acid	+ 17	c.c. H <sub>2</sub> O	—	25.0	13.0	10.0
9	c.c.	1/10	normal	acid	+ 16	c.c. H <sub>2</sub> O	—	23.0	14.0	10.0
10	c.c.	1/10	normal	acid	+ 15	c.c. H <sub>2</sub> O	41	21.5	14.5	10.0
12½	c.c.	1/10	normal	acid	+ 12½	c.c. H <sub>2</sub> O	—	18.5	15.0	10.0
15	c.c.	1/10	normal	acid	+ 10	c.c. H <sub>2</sub> O	31	17.0	16.0	9.0
17½	c.c.	1/10	normal	acid	+ 7½	c.c. H <sub>2</sub> O	—	14.5	17.0	9.0
20	c.c.	1/10	normal	acid	+ 5	c.c. H <sub>2</sub> O	—	14.0	18.0	8.5
25	c.c.	1/10	normal	acid			21	11.5	18.5	8.5
25	c.c.	water	(control)				8	8.0	8.0	8.0

(b) Fibrin swells more in the solution of any alkali than in pure water, but the amount of this swelling is greater in some alkalies than in others. This statement is the analogue of the corresponding one for acids. When equinormal solutions are compared fibrin swells more in potassium hydroxide than in sodium hydroxide, and more in either of these than in calcium hydroxide or ammonium hydroxide in the order named. Just as in the case of acids, so here, also, is the amount of swelling dependent upon the concentration of the alkali. Within certain limits there is an increase in the amount of swelling with every increase in the concen-

tration of the alkali, but after a certain point is exceeded a further increase in concentration is followed by diminution in the height of the fibrin column.

(c) If the amounts that fibrin will swell in acid and alkali solutions having the same H or OH concentration are compared, it is found that fibrin swells much less in the solution of an acid than in an equally concentrated solution of an alkali. While, for example, in a 1/50 normal KOH or NaOH solution, the fibrin column may be found to measure 83 and 77 mm. respectively, in a 1/50 normal HCl or HNO solution it measures only 48 and 35 mm.

(d) We come now to the interesting fact that the addition of any salt to the solution of an acid or an alkali decreases the amount that fibrin will swell in that solution. The only exceptions to this rule are formed by the salts which react with the acids. If barium chloride, for example, is added to a sulphuric acid solution, the amount of swelling is not decreased, but increased. This is because the insoluble barium sulphate is produced and thrown down, while hydrochloric acid is formed in which fibrin swells more than in an equally concentrated sulphuric acid solution.

The higher the concentration of the added salt, the less does the fibrin swell, and if enough is added the effect of the acid or alkali may be suppressed entirely.

(e) If the effect of equimolecular<sup>2</sup> salt solutions is compared, it is found that they affect the swelling of fibrin in solutions of acids or alkalies to a very unequal degree.

From the study of many series of salts it has been found that the effect of any salt is made up, in major part, at least, of the sum of the effects of its constituent ions. In any series of salts having a common kation the order in which the anions are effective is always found to be the same, and when series having a common anion are compared, the order in which the kations are effective is always the same. As a result of these experiments, the following tables have been constructed. The ion least effective in bringing about a

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<sup>2</sup>A molecular solution is made by dissolving a gram-molecule (the molecular weight of a substance including its water of crystallization, if it has any, expressed in grams) in enough water to make a liter. Solutions that contain the same number of gram-molecules in the unit volume are equimolecular.

diminution in the amount that fibrin will swell in the solution of any acid or alkali is in each case placed first:

ANIONS.	KATIONS.
Chloride.	Potassium.
Bromide.	Sodium.
Nitrate.	Ammonium.
Sulphocyanate.	Magnesium.
Iodide.	Calcium.
Acetate.	Barium.
Sulphate.	Strontium.
Phosphate.	Copper (ic).
Tartrate.	Iron (ic).
Citrate.	

The table for the anions is more accurate than the table for the kations. This is dependent upon the fact that the amount of difference in swelling produced by the end members of each of the two series is decidedly greater in the case of the anions than in the case of the kations. The general grouping of the kations is, however, entirely trustworthy. While the difference between the amount of swelling in an acid solution containing a magnesium salt may not differ decidedly from a similar solution made up with a calcium or barium salt, there is never any question about the difference between the action of any of these three and a kation found in the list either above or below them.

(f) Non-electrolytes do not share with electrolytes their marked power of reducing through their presence the amount that fibrin will swell in the solution of any alkali or acid. Even when employed in very concentrated solutions, glycerine, urea, saccharose, dextrose, ethyl alcohol and methyl alcohol do not change the height of the fibrin columns swelling in various concentrations of acid or alkali.

(g) The taking up and giving off (absorption and secretion) of water by fibrin represents to a very high degree a reversible process. If for a hydrochloric acid solution in which fibrin has attained its maximal swelling, an equally concentrated sulphuric acid is substituted, the fibrin column shrinks. The same thing occurs if a potassium hydroxide solution is replaced by an equally concentrated calcium or ammonium hydroxide solution. When equilibrium is finally established, the height of the fibrin column in each of these solutions is approximately equal to that which would have been attained had the

fibrin been placed directly in these solutions. In the same way fibrin which has attained its maximal swelling in an acid solution will shrink rapidly if for the pure acid there is substituted one of equal concentration containing a salt. Similarly, if water replaces the solution of an acid or an alkali, the fibrin will either shrink or swell more, depending upon whether the addition of the water makes the concentration of the alkali move toward or away from that which is optimal for the swelling of fibrin. (See paragraph b of this section.)

The reverse of all these experiments can also be accomplished, although not with the same ease. If, for example, hydrochloric acid is substituted for sulphuric, or potassium hydroxide for the calcium compound, an increase in the amount of swelling is noted, but the column does not rise as high as it would have done if placed directly in these solutions. Similarly, fibrin which has once been in an acid or an alkali solution containing a salt, when placed in pure solutions does not swell to the amount which it would have done if it had been put in these solutions from the first. All this would seem to indicate that fibrin suffers more or less permanently from every external condition to which it has been subjected. To explain this phenomenon we can advantageously call to mind the well known property of colloids of attaching to themselves and holding fast the various substances with which they come in contact.

### III. THE ANALOGY BETWEEN THE ABSORPTION OF WATER BY FIBRIN AND THE ABSORPTION OF WATER BY THE EYE.

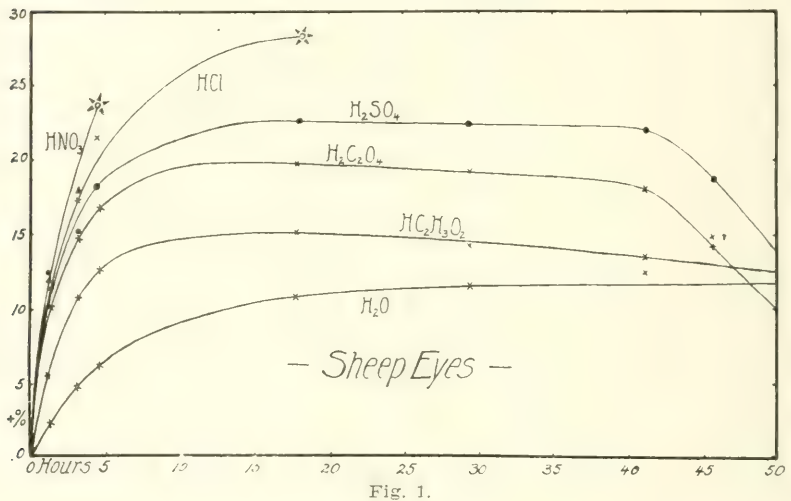
We will turn now to a consideration of the facts which are of immediate importance in the solution of our problem of glaucoma, namely, to those which show that the absorption of water by the eye is determined by the colloids contained in it, and the amount of such absorption upon the state in which these colloids find themselves.

The eye consists, as is well known, of a series of different tissues, the individual physical characteristics of which differ markedly from each other. There is no difficulty in distinguishing between the opaque sclera, the clear and transparent cornea, the well named "glass like" vitreous and the lens. The eye, in consequence, represents a collection of tissues which may be utilized as experimental material in our attempt to see if the analogy between the absorption of water by fibrin and the absorption of water by muscle cannot be broad-



ened to embrace an analogy between the absorption of water by fibrin and the absorption of water by protoplasm in general.

The following experiments show very clearly that *the absorption of water by the eye is governed by the same laws as the absorption of water by fibrin*. In these experiments the eyes of sheep, pigs and cattle were employed shortly after their removal from the animals at the slaughter house. For the most part sheep eyes were used, but identical results can be obtained with the eyes of pigs or cattle. To avoid useless details only the conclusions from many series of experiments



are given below, and these have been arranged in lettered paragraphs which correspond with similarly lettered ones in the section on the swelling of fibrin. In this way what has been said of fibrin may easily be compared with what is said regarding the absorption of water by the eye.

Let it be added that the eyes had all been carefully trimmed of adhering tags of muscle and fat, and that the amount of the absorption of water was determined by weighing the eyes at various intervals, and calculating the increase or decrease in weight in per cent of the original weight of the fresh (moist) eyes. The eyes were kept in lightly covered finger bowls containing enough of the various solutions to cover the eyes. Two hundred cc. are about sufficient for sheep eyes, while the large cattle eyes demand 300 cc. To carry out the weighings the eyes were taken out of their solutions, carefully dried

with soft filter paper, and weighed as quickly as possible on balanced powder papers, such as are employed by pharmacists.<sup>3</sup>

The following conclusions are of importance in our discussion:

(a) An enucleated eye absorbs more water in the solution of any acid than in distilled water, but when equinormal acids are compared these are found to be equally effective in this regard. Figure 1 shows graphically the results of a few such experiments with 1/110 normal acids. As is easily apparent, the swelling in hydrochloric and nitric acids is sufficiently

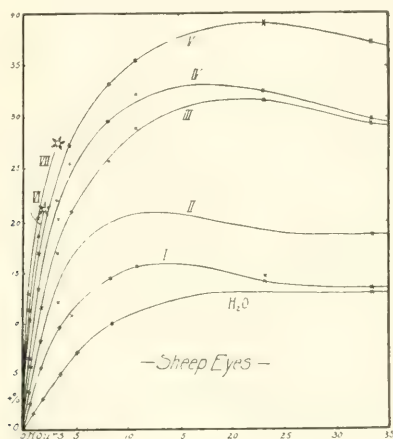


Fig. 2.

great to lead to a rupture of the eyeball, the sclera splits and allows the escape of the more fluid contents of the eye. Rupture of the eyeball is indicated in this figure and in all that follow by the five cornered star at the end of the curves. Sulphuric, oxalic and acetic acids are all less potent in making eyes swell, for the absorption curves with these acids are decidedly lower, in the order named, than those for nitric and hydrochloric acids. In none of these does a rupture of the eyes occur at the concentrations employed. The curve obtained by immersion of an eye in pure water is introduced for comparison.

The amount that an eye swells in any acid solution is dependent on the concentration of the acid. This is illustrated in Fig. 2. The curve for pure water is the lowermost one. The

<sup>3</sup>For detailed weighings and figures see Martin H. Fischer: *Pfluger's Archiv*, 1908, CXXV, 396, and *ibid*, 1909, CXXVII, 1.

Roman numerals indicate progressively higher concentrations of hydrochloric acid. The solutions were made by adding 2, 4, 6, 8, 12, 14 and 16 cc. of a 1/10 normal hydrochloric acid to enough water to make 220 cc. of solution. The acid solutions vary in consequence from (approximately) a 1/1100 normal to a 1/110 normal. A definite increase in the amount of swelling with every increase in concentration is readily discernible. In the highest concentrations the absorption of water is suffi-

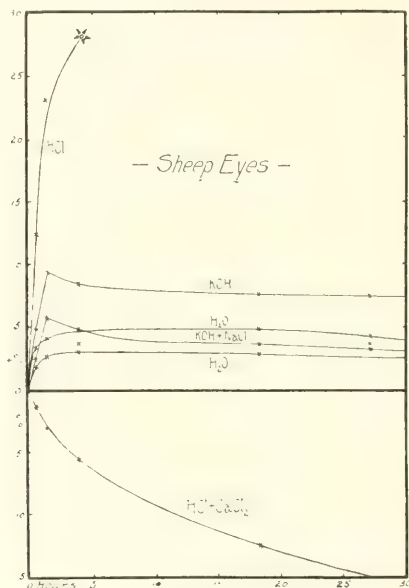


Fig. 3.

ciently great (and sufficiently rapid) to lead to rupture of the eye.

It is of extreme interest to note how low a concentration of acid brings about a decided absorption of water by the eye. The lowest concentration of hydrochloric acid in this series does not betray its acid character to the sense of taste; the second has a taste but it cannot be recognized as sour. It requires imagination to recognize the acid taste even in the third concentration in which an eye becomes stony hard.

(b) Eyes swell more in the solution of an alkali than in pure water. While there is no question about this fact (see Figure 3), the amount of difference in swelling between an eye in pure water and one in the solution of an alkali is not as great

as that between an eye in water and one in acid solution. The explanation for this is probably as follows: The eye after removal from the body undergoes a spontaneous acid change. This acid is neutralized by the alkali of the solution into which the eye is dropped, whereby a salt is formed, the presence of which inhibits the swelling of the eye in the alkaline solution. (See below.)

The different alkalies affect the swelling of eyes to unequal degrees when equinormal solutions are compared, but the exact

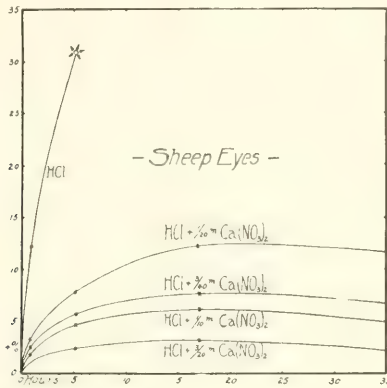


Fig. 4.

order in which these different alkalies are effective is not yet definitely settled.

(c) If the amounts are compared that an eye will swell in acid and in alkaline solutions having, respectively, the same H or OH concentration, it is found that an eye swells *less* in the solution of an alkali than in an equally concentrated solution of an acid. The probable cause for this divergence from the behavior of fibrin has already been touched upon in the preceding paragraph.

(d) The presence of any salt in the solution of an acid or an alkali reduces the amount that an eye will swell in that solution. Figure 3 illustrates this fact as well as Figures 4, 5 and 6. In Figure 3 is easily noted the great difference in the amount of swelling induced in eyes through the action of equinormal solutions of acids and alkalies. The solutions of HCl and KOH are both 1/110 normal made by adding 20 c. c. of a 1/10 normal hydrochloric acid or potassium hydroxide solution to 200 c. c. of water. When an eye is placed in solutions made

by adding the same amounts of acid or alkali, respectively, to 200 c.c. one-fourth molecular solutions of calcium chloride or sodium chloride, the curves marked  $\text{HCl} + \text{CaCl}_2$  and  $\text{KOH} + \text{NaCl}$  are obtained. The curve of absorption in pure water is introduced as a control.

Figure 4 shows that the higher the concentration of the added salt, the less does an eye swell in an acid solution. The eye bursts in pure hydrochloric acid solution made by

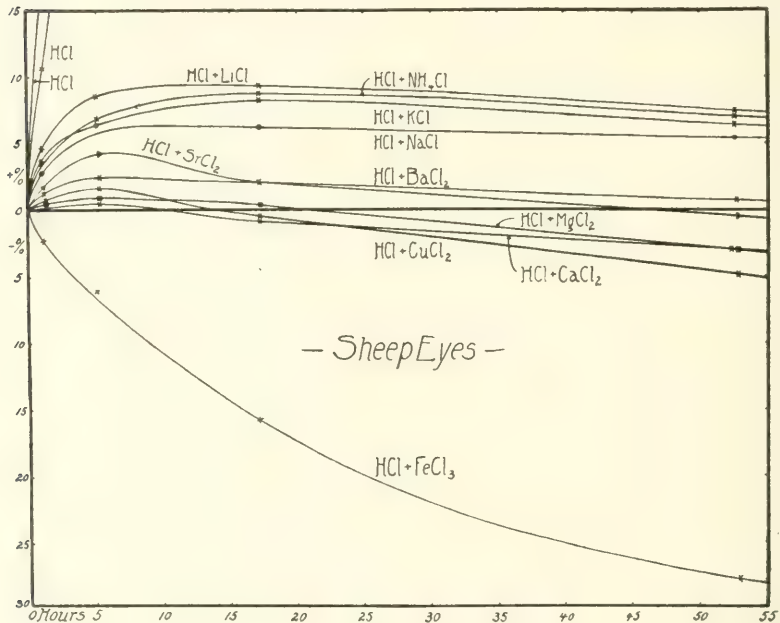


Fig. 5.

adding 20 c.c. 1/10 normal hydrochloric acid to 200 c.c. of water. The remaining curves are self explanatory if it is stated that 20 c.c. 1/10 normal hydrochloric acid are added in each of these cases to 200 c.c. of the appropriate solution of calcium nitrate.

(e) When the effect of equimolecular solutions of different salts on the absorption of water by eyes in acid solutions is computed, it is found that the different salts are very unequally effective in this regard. As in the case of fibrin, the effect of any salt seems to be made up of the sum of the effects of its constituent ions. Figure 5 permits the comparison of the action of different kations. The eyes burst in



both of the pure hydrochloric acid solutions. This occurred in none of those to which a salt has been added. These solutions containing salt were all made by adding 20 c.c. 1/10 normal hydrochloric acid to 200 c.c. one-sixth molecular solutions of the different chlorides. The ions arrange themselves in about the following order, in which that least effective in reducing the amount of swelling in an acid solution is placed highest in the series, and first in each group:

Lithium, Ammonium, Potassium, Sodium;

Barium, Strontium, Magnesium, Calcium, Copper (ic);

Iron (ic).

We have small difficulty in discovering in this table the

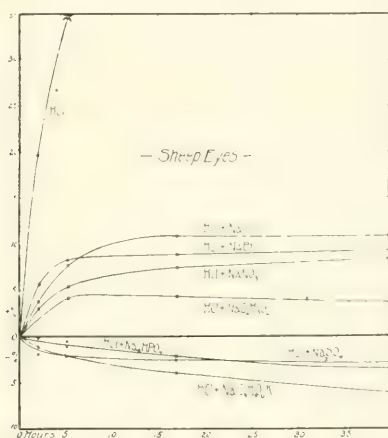


Fig. 6.

same grouping of ions familiar to us from our discussion of the swelling of fibrin.

In Figure 6 are shown the effects of different anions. In such case 20 c.c. 1/10 normal hydrochloric acid are again added to 200 c.c. of a one-sixth molecular solution of the appropriate salt. The order of the ions is as follows, in which that least effective in reducing the amount of swelling in an acid solution is again placed first.

Chloride, Bromide, Nitrate, Acetate.

Phosphate, Sulphate, Tartrate.

This table is to all intents and purposes identical with that given in the discussion of fibrin.

(f) Non-electrolytes do not share with electrolytes their marked power of influencing through their presence the absorp-

tion of water by the eye. Figure 7 shows this better than many words. The curves lie very closely together, and in spite of the fact that the various non-electrolytes are present in amounts which are osmotically more than equivalent to the powerfully acting electrolytes (20 c.c. 1/10 normal HCl + 200 c.c.  $\frac{1}{3}$  molecular solution of the non-electrolyte), not one of the eyes has been kept from bursting.

(g) The absorption and secretion of water by the eye is to

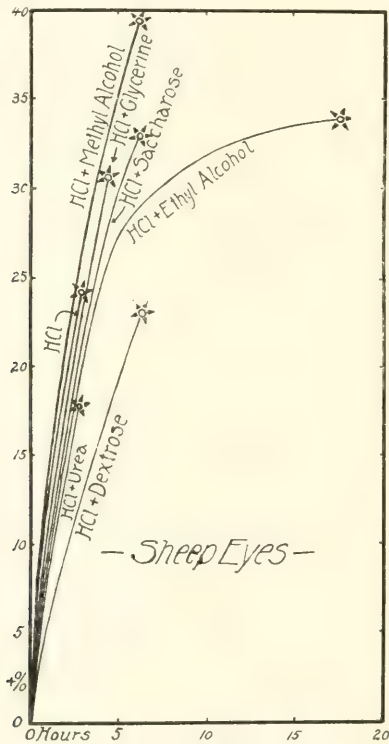


Fig. 7.

a large extent a reversible process. This is indicated in Figure 8. Curve A shows how an eye which has reached the bursting point in a pure hydrochloric acid solution suffers a prompt loss of water if taken out of this solution and transferred to an equally concentrated one containing calcium chloride in addition to the hydrochloric acid. Curve B shows the reverse of this process. An eye which has gained but little weight in pure water is transferred to a dilute hydrochloric acid solution. Immediately the absorption of water is hastened, and becomes

so great that the eye bursts. Let it be mentioned in conclusion that the eye also suffers somewhat permanently from every condition through which it has passed. Once, for instance, an eye has been in an acid solution containing a salt, it does not subsequently swell as much in a pure acid solution (in the time allowed in these experiments) as it would have done had it been placed here directly.

#### IV. ON THE NATURE AND THE CAUSE OF GLAUCOMA.

From a pathological standpoint, glaucoma represents simply one of the local cedemas, and from a clinical point of view, all

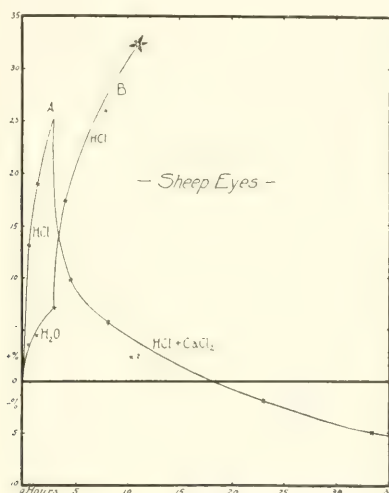


Fig. 8.

the symptoms and signs of this condition are considered referable to the increased intraocular pressure induced through the abnormally large amount of water held by the eye in this condition. How does the eye come to hold such an increased amount of fluid?

A glance at any of the standard works on ophthalmology<sup>4</sup> shows no dearth of attempts to answer this question, but experiments planned to support the views advanced by the various authors have been singularly unsuccessful. For the most part, when not simply referred to the occult properties of "living" matter, these explanations are identical with those given for cedema anywhere else in the body. They are familiarly me-

<sup>4</sup>See, for example, Ernst Fuchs, *Augenheilkunde*, Dritte Auflage, Leipzig u. Wien, 1893, 393; Priestly Smith, *Glaucoma*, London, 1891.

chanical in character in that an increased lymphatic or blood pressure is supposed to force an abnormally large amount of liquid into the tissues of the eye. Such increased pressures are generally held to be induced through interference with the outflow of lymph or blood from the eye occasioned through obliteration of the "filtration angle," etc.

The experiments which we have detailed in the previous section of this paper showed very clearly that *the most intense grades of glaucoma can be induced experimentally in an eye in the entire absence of any circulation*. This fact, coupled with the well-known observation that an increase of the pressure of the circulating liquids through the eye is not followed by glaucoma arraigns all explanation of glaucoma which look to an increased pressure as of essential importance in its causation. *We are at the same time led to conclude that the cause of glaucoma may well reside in the tissues of the eye itself, and that it becomes glaucomatous not because fluid is pressed into it, but because through changes in it, it absorbs an increased amount of water*. That the amount of such absorption is sufficient to explain the severest grades of glaucoma ever observed clinically is clearly enough evidenced by the fact that through the mere presence of a little acid, an ox eye can be made to absorb enough water to rupture its enormously thick sclera. This is a grade of glaucoma that exceeds anything that we ever have the opportunity of observing clinically. Our experiments further show that *this increased absorption of water by the eye is dependent upon the colloids in the eye, for not only is the eye built up of a series of different colloids (sclera, cornea, lens, vitreous humor), but the same conditions which govern the absorption of water by fibrin also govern the absorption of water by the eye*. On the ground of these experiments we can, therefore, no longer insist that an eye becomes glaucomatous because water is forced into it. *It does this because chemical changes occur within the eye which increase the affinity of the ocular colloids for water so that these are enabled to absorb water from any available source*. In our experiments with enucleated eyes this source is the solution into which the eye has been dropped; in the body it is the liquids flowing about or through the eye.

Just what are the chemical changes in the eye in clinical cases of glaucoma we are not able to say definitely; but there can be little doubt that the cause of this cedema is in essence

the same as that of any of the more generalized ones.<sup>5</sup> In a large number of glaucoma cases, circulatory disturbances in the eye which permit of an accumulation of carbon dioxide and the abnormal development of such acids as are a constant accompaniment of states of lack of oxygen, are unquestionably present. In the glaucomas due to infections or, in general, toxic agents capable of producing inflammatory changes (in the strict pathological sense of the term) in the eye, we have to look to the chemical changes induced by these for the cause of the altered affinity of the ocular colloids of water. Under the influence of proteolytic forments, for example, ordinary gelatine can be converted into Beta-gelatine. As pointed out by Wolfgang Ostwald studies, this is capable of greater swelling than the unchanged gelatine. It is therefore conceivable that in inflammation (whether in the eye or elsewhere) an increased affinity of the tissue colloids for water and a consequent oedema may result merely in consequence of the "autolytic" changes that occur in the injured tissues, even when no abnormal storage or production of acids in the part occurs. The best evidence in support of this colloidal conception of glaucoma is, however, not furnished by these mere hypothetical discussions, but by the following clinical observations.

#### V. ON THE RELIEF OF CLINICAL CASES OF GLAUCOMA.

##### 1. LOCAL TREATMENT.

The experiments which I have described on the swelling of enucleated eyes made us familiar not only with ways and means by which an intense glaucoma can be induced in an eye, but they showed us also how the development of such a glaucoma can be prevented, or, once established, be made to go down again. While under ordinary circumstances little is to be gained by simply reducing an oedema, there exist a number of clinical forms which are in themselves dangerous. Glaucoma is one of these which through its existence for even a short time may permanently blind an eye. To be able to combat the oedema in such a case is, therefore, not a useless procedure.<sup>6</sup>

In the experiments on the swelling of eyes, we became familiar with the fact that the presence of any salt markedly decreases

<sup>5</sup>See my volume on Oedema, New York, 1910.

<sup>6</sup>Oedema of the larynx, oedema of the kidney (acute suppression of urine), and oedema of the brain (for example, after traumatism) are also dangerous. All these are reducible through salt and alkali solutions of the right kind and concentration. Pulmonary oedema also belongs in this class, but presents a more complex problem than the other ones so far as reduction is concerned. See my volume on Nephritis for details in treatment.



the amount that an eye will swell in an acid solution. The question, therefore, arose whether the instillation of salt solutions into the eye might not be followed by relief in clinical cases of glaucoma.

Hayward G. Thomas and I decided to test the matter.<sup>7</sup> The instillation of salt solutions was not, however, to be entered into hastily, for my experiments had shown that *while all salts reduce the amount that an eye will swell in an acid solution, a large number also increase the tendency to the development of corneal opacities*. There would be little gained, except so far as relief from certain of the subjective symptoms might be concerned, by guarding an eye from blindness through glaucoma while blinding it through the agency employed for the relief of the glaucoma. *There exist, however, a number of salts which inhibit markedly the swelling of eyes in acid solution and at the same time not only do not increase but even decrease the tendency to the development of these corneal opacities*. In other words, the use of these salts tends to prevent the development of even that well-known turbidness of the cornea which is so constant a sign in clinical cases of glaucoma, and which one never fails to get in the experiments on eyes that I have described. (See the succeeding section.) These salts are the citrate, tartrate, sulphate and phosphate of sodium and potassium. After a number of preliminary tests we chose sodium citrate as the salt best adapted for use in clinical cases of glaucoma. We use only the chemically pure salt in concentrations varying from a  $\frac{1}{8}$  to a  $\frac{1}{6}$  molecular solution. Expressed in per cent, the former is equivalent to a 4.05 per cent solution, the latter to a 5.41 per cent solution of the ordinary crystallized sodium citrate ( $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 + 11\text{H}_2\text{O}$ ). The  $\frac{1}{8}$  molecular solution has an osmotic pressure below that of the human tissue fluids, the  $\frac{1}{6}$  molecular solutions one that is slightly above. The injections are made with a fine needled hypodermic under the conjunctiva in the usual manner adopted by ophthalmologists and are preferably preceded by the use of cocaine and adrenalin solutions. Enough of the sodium citrate is injected to gently distend the connective tissue spaces (5 to 15 drops). Immediately following the injection the patient suffers some pain. While this is usually insignificant, it is fairly severe in certain cases. When this is true, alternate hot and cold compresses laid over the eye ease the

<sup>7</sup>Hayward G. Thomas and Martin H. Fischer: *Annals of Ophthalmology*, 1910, January; Hayward G. Thomas: *Journal of Ophthalmology and Otolaryngology*, 1911, July.

pain. In any event it disappears in a few minutes. In the severer cases of glaucoma we use the stronger sodium citrate solution, in the milder cases or for subsequent treatment the  $\frac{1}{8}$  molecular solution is sufficient. This will, in fact, rapidly reduce the tension in even the severe cases of glaucoma. Later in the treatment, a mixture of one part of the  $\frac{1}{8}$  molecular sodium citrate solution with two to four parts of a physiological (0.9%) sodium chloride solution is sufficient.

Our results may be summed up as follows:

*The use of subconjunctival injections of a one-eighth to one-sixth molecular (4.05 to 5.41%) solutions of chemically pure sodium citrate in clinical cases of glaucoma is entirely harmless and is always followed by a prompt fall in ocular tension. The fall in tension is appreciable within ten minutes after the injection and may be so great as to make the eye have a subnormal tension. The effect of such a subconjunctival injection lasts for from three to six days (or even more) and is accompanied by a relief of all the subjective symptoms of glaucoma (except, of course, the blindness due to structural changes.)*

It must be clearly understood that when such subconjunctival sodium citrate solutions bring about a diminution in the tension of a glaucomatous eye, this does not constitute a "cure" for glaucoma. As a cure of glaucoma we could only consider a removal of that condition or conditions which are responsible for the development of the substances which increase the affinity of the ocular colloids for water. If these are acids, the product of a circulatory disturbance or of an infection, then clearly the real cure for the glaucoma resides in a correction of the circulation to the eye, or in the removal of that infection. But even toward this end the sodium citrate injections can help. In the progressive development of a glaucoma the swelling of the colloids tends to compress the blood vessels passing into and out of the eye-ball. The natural tendency of a glaucoma is, therefore, to make itself worse. Writers on ophthalmology are in the habit of laying great stress on the *obliteration of the filtration angle*. This is frequently said to be the cause of glaucoma. It is much more probably a consequence as evidenced by the fact that enucleated eyes rendered artificially glaucomatous by being placed in acid solutions show the same progressive decrease in the depth of the anterior chamber that is noted in clinical cases. The matter is easily explained through the unequal swelling of the different colloids of the eye, those posterior to the lens

(sclera, choroid, vitreous) being capable of greater swelling than those anterior to it (cornea, aqueous).

Through this unevenness in swelling the ciliary body is crowded against the sclera—a process in which the blood vessels of the ciliary body become pinched. Such an embarrassment in the circulation (lack of oxygen, accumulation of  $\text{CO}_2$  and acids) is then added to whatever conditions are already active in producing the glaucoma. To reduce the swelling of the ocular colloids, even though only temporarily, is therefore to improve the circulation through the eye and in this way to contribute not inconsiderably toward the restitution of normal conditions within the eye. If the glaucoma is the consequence of some acute conditions, then its prompt relief may not only save the eye from blindness through pressure, but by helping toward the re-establishment of a normal circulation through the eye furnish the necessary conditions required in the repair of all pathological processes.

There is a marked tendency in the recent literature on the treatment of glaucoma to urge more strongly than formerly the use of myotics and constitutional remedies for the relief of glaucoma. This has very largely grown out of the fact that iridectomy all too often fails to give more than temporary relief. All the medical means at our disposal have as their main object the mere reduction of tension in the eye. All too often the recognized remedies barely affect the ocular tension and the relief obtained is unsatisfactory. These sodium citrate injections, therefore, seem to mark a distinct therapeutic advance, for they *always* reduce tension, and promptly. Whatever improvement can be hoped for through simple reduction of the ocular tension can therefore be expected with greater confidence when sodium citrate injections are used than when any of the other customary medical means are employed. But even should a surgical procedure ultimately be deemed necessary or advisable, the surgical difficulties and dangers arising at times from having to operate upon the eyes with a high tension may be entirely controlled through previous subconjunctival sodium citrate injections.

## II. SYSTEMIC TREATMENT.

It is not enough, after having reduced the tension in a glaucomatous eye by the subconjunctival injection of sodium citrate to let the matter rest. Every effort must be made to

discover the various factors that are responsible for the chemical changes (acid production) that lead to the increased swelling of the ocular colloids. It is self apparent that an accumulation of acid in an eye leads to a swelling of the ocular colloids no matter whether the origin of this acid is purely local (say the consequence of an arterio-sclerosis of the blood vessels of the eyeball), or whether glaucomatous attack is precipitated because to this local acid production is added the effects of acids produced elsewhere in the body and carried into the eye through the circulation.

The conditions that lead to an abnormal production or accumulation of acid in the body as a whole are many, and constitute a list that is familiar to every ophthalmologist under the heading of etiological factors concerned in the production of glaucoma. Starvation, an excessive protein diet, hard muscular and mental work, excessive consumption of sour wines, various intoxications (anesthetics, alcohol, arsenic), the severe anemias, generalized arterio-sclerosis, kidney disease, uncompensated heart lesions, exposure to cold, are all associated with an abnormal accumulation or production of acid in the body. Any of these may be the deciding factor that pushes the eye on the verge of glaucoma from a local condition over the line, and so precipitates the glaucomatous attack.

Where it is possible it is clearly indicated, therefore, that we remove such conditions in our patient. But this is not always possible, or at least not with sufficient speed to make it count in our patient who finds himself in the midst of a glaucomatous attack. Under these circumstances we have only one other door open to us, and that is to combat the consequences of these various conditions, in other words the abnormal acid production or acid accumulation itself. We do this by making use of three procedures: First, we give the patient alkali to neutralize the acid; second, we give him salts to reduce the swelling of his colloids under the influence of such acid as may be present; third, we give him an abundance of water, day *and* night to help wash out the acid from his various tissues through his kidneys.

How in actual practice this is accomplished is about as follows: In addition to putting our patient at rest, increasing the vegetable side of his diet and reducing his protein intake, etc., we give him a glass of plain water or Vichy water every hour both day and night, adding to this half a gram of sodium

carbonate. We instruct him to salt his food, and arrange for such articles of diet as will take salt readily (salt meats, fish, etc.). Under ordinary circumstances this will suffice to thoroughly alkalinize our patient in from 24 to 72 hours. If for any reason we wish to get these systemic results more speedily we can give hypertonic sodium chloride solutions containing sodium carbonate in addition by rectum. The following is a useful formula:

Sodium chloride, 14 grams.

Sodium carbonate (crystallized), 15 grams.

Water, 1000 c. c.

If crystallized sodium carbonate is not available, the dried (stronger) preparation may be used; *but of this only one-third the amount must be employed. The solution must not be made up in hot water, for this drives off the carbon dioxide and so converts the carbonate into the stronger and more irritating hydroxide.*

The whole liter of solution may be injected into the rectum by allowing it to trickle in slowly at a temperature of 105 to 110 degrees F. Or, the liter may be given in four divided doses of 250 c. c. each at intervals of half an hour. Even when considerable portions of such enemata are rejected after being retained some time, they have done much good, for the alkali and salt are absorbed much more rapidly than and independently of the water.

When we have succeeded in relieving an attack of glaucoma, and it is our purpose to prevent further attacks, we make use of the same principles already enunciated for the relief of the condition, though it is not necessary, of course, to work so aggressively. We need again to avoid those conditions which threaten an abnormal production or accumulation of acid, and to increase the margin of safety against these by a quieter insistence on a diet rich in alkalies, salts and water.<sup>8</sup>

#### IV. ON THE NATURE OF CORNEAL OPACITIES.

In clinical cases of glaucoma there is noted as one of its most constant signs more or less opacity of the cornea. In an entirely similar manner the cornea loses its transparency

<sup>8</sup>The problem of glaucoma and the problem of nephritis are identical, strange as such a fact seems at first sight. The swelled eye-ball of glaucoma is the swelled kidney of nephritis. The conditions leading to each are identical, and the principles of their relief the same. See my monograph on Nephritis, New York, 1911.



in the experimentally induced glaucomas that were described above. Inasmuch as the essential change in the eye in glaucoma consists of an abnormal increase in the amount of water held by the eye, the view generally advanced by ophthalmologists that the opacities of the cornea noted in glaucoma are due to the absorption of water by the cornea does not surprise us. Such an origin for the opacities has been extended to include the other transparent media of the eye. Especially has the lens been believed to owe its loss of transparency in many conditions to an inhibition of water.

Serious objection seems never to have been raised against such a view, and this in spite of the fact that clinical cases of absolute opacity of the cornea or the lens may exist without any evidence of an increased absorption of water, while, on the other hand, very severe cases of glaucoma may come and go without more than a mere haziness of the cornea.

The remarks of these paragraphs confine themselves to the question of the origin of *corneal* opacities, simply because these have been studied with greatest care. It seems from preliminary experiments, however, that what is here said regarding the cornea holds also for the lens and the other transparent media of the eye. The opacities in the eye to which these remarks refer necessarily include only such as are the consequence of chemical disturbances in the eye, and have nothing to do with the deposits of leucocytes, formation of connective tissue, etc., which may also give rise to opacities.

*Neither the presence of an increased or a decreased amount of fluid in the cornea is responsible for the appearance of an opacity. An opacity is produced whenever some of the colloidal constituents of the cornea are precipitated, and depending upon whether such a precipitation is only slight or very great these opacities vary from such as are barely visible (steaminess of the cornea) to such as are intensely white (leukoma).*

The effect of different solutions on the transparency of the cornea was judged in two ways: First, in regard to the *rate* at which they permitted the development of an opacity; and, second, in regard to the *intensity* of the opacity. The outer limits of the former vary from a few minutes to several days, for the latter from a turbidness scarcely visible to the naked eye to a whiteness like that of boiled albumin. The conclusion drawn above is based upon the following facts:<sup>9</sup>

<sup>9</sup>See Martin H. Fischer: *Pflüger's Archiv*, 1909, 127, p. 46.

(a) If an eye is simply allowed to dry no opacity of the cornea develops. Simple loss of water, therefore, does not lead to the development of an opacity.

(b) If an eye is laid in distilled water it gains in weight. In this process of water absorption, the cornea takes a prominent part, yet no turbidness of this structure develops until quite late. Simple absorption of water, therefore, does not lead to opacity.

(c) The presence of any acid favors the development of an opacity, but the different acids are very unequally powerful in this regard. Nitric acid induces a corneal opacity more quickly than an equinormal oxalic acid solution, and this more quickly than an equinormal hydrochloric acid. Still less powerful in this regard are sulphuric and acetic acids in the order named. Very clearly, therefore, this order in which acids induce corneal opacities is entirely different from the order in which they make eyes swell.

(d) We note a further discrepancy between the amount of water absorbed by an eye and the rate of development, or better, the intensity of a corneal opacity as soon as the effect of adding equimolecular salt solutions of different kinds to any acid solution is compared. While every salt reduces the amount of water absorbed by an eye in an acid solution, some salts favor the development of an opacity while others distinctly inhibit it. The citrate, acetate and sulphate, for example, inhibit the development of a corneal opacity, while the sulphocynate, nitrate, bromide and chloride favor it.

(e) The effect of any salt seems to be made up of the algebraic sum of its constituent ions. When a series of salts having a common base are compared, the order of the acid ions is always found to be the same, and when a series of salts having a common anion are compared, the order of the kations is always seen to be the same. The order in which various anions and kations are effective in producing or inhibiting the formation of corneal opacities is indicated in the following two tables, in each of which the ion most effective in producing an opacity is given first, that most effective in inhibiting it last:

Sulphocynate, nitrate, bromide, chloride, sulphate, acetate, citrate.

Iron (ferric), copper (cupric), calcium, strontium, barium, magnesium, ammonium, sodium, lithium (?)

The order in which different salts, or, as we had best say, different ions, affect the production of these corneal opacities is therefore an entirely different one from the order in which these same ions affect the absorption of water by the eye. Not only are such ions (sulphocynate, nitrate, iron, copper) as are most powerful in leading to the development of corneal opacities found in the same group with such as allow the least absorption of water by the eye, but such as inhibit the formation of corneal opacities most powerfully (acetate, ammonium) are in a class with those which have the least effect on the absorption of water.

This absolute disproportion between the amount of water absorbed and the development of a corneal opacity is well illustrated in Figure 5.

In *a* is shown the thickness of the cornea of an eye which has lain in distilled water for 36 hours and is still perfectly clear. In *b* we have an eye that has remained for the same length of time in a 1/110 normal hydrochloric acid solution. The eye burst six hours after being placed in this solution. The cornea is very thick but only slightly opaque (ground glass appearance); *c* was left for 36 hours in a similarly concentrated hydrochloric acid solution, containing magnesium nitrate in addition (20 c. c. 1/10 n. HCl + 200 c. c. 1/3 Mg (NO<sub>3</sub>)<sub>2</sub>). In spite of the fact that the cornea is not swelled—it is thinner even than normal—it has the intensely white color of boiled albumin. About the same condition of affairs is shown in *d*, which indicates the appearance of an eye 36 hours after being placed in a 1/110 normal hydrochloric acid solution plus ferric chloride (20 c. c. 1/10 HCl + 200 c. c. 1/3 m. ferric chloride). In spite of the great loss of water the thin cornea is intensely white (and stained slightly yellow from the iron chloride).

(f) In the experiments on the swelling of eyes it was found that non-electrolytes do not markedly affect the swelling of eyes in an acid solution. Nevertheless most non-electrolytes appreciably inhibit the development of corneal opacities.

(g) All the above facts have shown most clearly how *no* parallelism exists between the amount of water absorbed by the cornea and the intensity or rapidity of the development of an opacity in it. We need in conclusion only to state that all the facts outlined above are easily harmonized by the con-

ception that a corneal opacity represents the precipitation of a colloid—a protein—within the cornea.

*Every statement made above regarding the conditions which favor or inhibit the development of a corneal opacity is merely the parallel of a similar statement familiar to us from the observations of Wolfgang Pauli,<sup>10</sup> on the effects of acids, bases, salts and various non-electrolytes on the precipitation of protein.*

With this we may conclude our discussion of the essential nature of the opacity of the cornea noted in glaucoma. In the light of our remarks the steaminess of the cornea in clinical cases of glaucoma becomes evidence for the development of acid in the eye in this condition. At the same time this form of opacity becomes grouped with the opacities that are due to the instillation of silver and copper salts into the conjunctival sac, opacities which we have long been accustomed to regard as protein precipitation (coagulations). We have already pointed out that opacities in the lens and vitreous are undoubtedly of the same character. The chief point to which I would like to call attention in this connection is *the possibility of the absorption of these opacities*, be they in the cornea or any other of the transparent media of the eye. We generally regard the protein precipitations as irreversible, that is to say, that if once produced they cannot be made to go back into "solution." But this statement is true only in a general sort of a way. The length of time that a precipitate has endured is, first of all, of importance; and, second, the exact character of the precipitate. If, for example, it has been produced by a heavy metal it is less reversible than if produced by a lighter one. The important part is that there seems always to exist *some* degree of reversibility.

This fact is of great clinical importance. It accounts, first of all, for the disappearance of the steaminess of the cornea in attacks of glaucoma. But more than this, the very important fact suggests itself, that through the use of proper solutions we ought not only to be able to inhibit the development of opacities in the transparent media of the eye, but also aid their absorption ("solution") after once having been formed. It was found above that the presence of citrate (sodium citrate) not only does not favor but actually inhibits the formation of opacities. It was this fact, together with

<sup>10</sup>Hofmeister's Beiträge, 1903, 3, p. 225; 1904, 5, p. 27; 1906, 7, p. 531. Note particularly the effect of different salts on the precipitation of protein which carries a positive charge due to the presence of free hydrogen ions.

its great power of reducing the affinity of colloids for water, that made this salt the one of choice for subconjunctival injections in glaucoma. But the question naturally suggested itself whether the same salt injections might not favor the solution of opacities, even in cases not associated with increased tension. Hayward G. Thomas is testing out this matter in a series of eyes with diminished vision due to opacities in the cornea, lens and vitreous. He has noted a decided improvement in all studied thus far and has obtained this to a degree and at a rate that cannot be attributed to the mere "spontaneous" improvement frequently noted in these cataractous and other eyes.

#### DISCUSSION.

DR. S. D. RISLEY, Philadelphia:—He had rarely undertaken anything with more perturbation than the discussion of this most interesting paper by Dr. Fischer. He had been deeply interested in the subject as presented, but did not know that he was to open the discussion, which he regretted, since he had had no opportunity to study the important thesis of Dr. Fischer. He was, therefore, compelled to give his first impressions. He was, moreover, extremely anxious on the one hand not to do an injustice to such an important subject, and on the other was not willing to commend without adequate study. His attitude, therefore, was one of neutrality and an open mind. While some features of the glaucoma symptom complex seemed to support the doctor's contention, Dr. Risley thought those surgeons who had had much experience with glaucoma must agree with him that there were many phenomena occurring in the clinical manifestations of the different types of glaucoma which did not drop readily, at first sight, into Dr. Fischer's conception of the disease. The inflammatory types of glaucoma were more apt, indeed, to be associated with the general systemic conditions which in their later manifestations presented themselves as a local phase of a general arterio-sclerosis, or cardio-vascular disease with kidney involvement as a part of the symptom complex.

The picture of disease he had in mind was an injected eye ball with increased tension and pain, associated with high blood pressure, sclerosed arteries, an acid urine of high specific gravity, showing traces of albumin of sugar, granular and hyaline casts. This ensemble of symptoms had long been associated in the professional mind with the so-called uric acid diathesis and seemed quite in accord with the thesis of the essayist. So far he had been deeply interested in the contention of the paper, as expressing the result of Dr. Fischer's investigations. Dr. Risley thought, however, that it was more difficult to accept the theory of an acidosis of the tissues as an etiologic factor, in simple or non-inflammatory glaucoma, which he had seen occur in a large group of patients in whom the most painstaking study failed to demonstrate any serious systemic disease or any cedema of the intraocular membranes; but, in whom nevertheless after blindness had ensued from more or less constant increase of tension or by vagrant or transient attacks of subacute inflammatory glaucoma—had not infrequently in his experience resulted in fulminating absolute glaucoma. It was only fair to say, however, that in one of these cases the sudden attack had come on in association with



an attack of rheumatic gout. As regards the local treatment of inflammatory glaucoma by the local instillations of alkaline solutions, he had frequently seen the steamy cornea become clearer by the subconjunctival injections of a physiologic salt solution. Then, too, as favoring the conclusions of the essayist it had been his habit as a general therapeutic measure in inflammatory glaucoma and many other forms of ocular disease, especially affections of the uveal tract, to administer the soluble alkaline earths, the sulphate of magnesia and the chloride of calcium having proved of signal value. In a word, while accepting the theory of an acid oedema as an interesting and valuable suggestion as an etiologic factor in certain phases of glaucoma, he thought that in the present state of our knowledge it did not warrant a too dogmatic statement.

DR. D. T. VAIL, Cincinnati:—I think in discussion it might be best for me, at least, to call your attention to a few of the more recent observations in connection with the pathogenesis of glaucoma. We are all familiar with the teachings and observations of the older authorities in connection with the pathogenesis of glaucoma. But I thought I would write down my observations and readings as to more recent investigation on this subject.

Judging from recent literature on the subject, the modern oculists are pretty well agreed that primary glaucoma is set up by diseased blood vessel walls (angio-sclerosis affecting the ciliary processes) and that these results increased blood pressure within these vessels, causing an albuminous aqueous to be poured out, which, on account of its superabundance and heavy nature, blocks the channels of exit.

Arnold Knapp (*Knapp's Archiv. Ophthal.*, March, 1908) states: "In these conditions the aqueous humor is altered from an *albuminous effusion*, an altered secretion from the ciliary body." Fuchs states (Text Book, second American edition, page 383): "The aqueous is more albuminous and coagulates readily in the air and in hardening fluids." It stands to reason that if this thick albuminous or fibrinous exudate once pours out from the ciliary processes, it will set up the train of symptoms, partly because it crowds the lens and iris forward, thus blocking the only or practically the only exit for the aqueous, and partly because of its thick consistency. The small outlets for the limpid normal aqueous will not accommodate the passage of this thick gluey exudate.

In a paper on glaucoma read by Tenny of Boston at a recent meeting of the A. M. A. at Atlantic City is found the statement, which coincides with the view just expressed: "It would seem that glaucoma must be caused by excessive pressure in the vitreous chamber caused by diseased blood vessels in the uveal tract, at the same time there is probably alteration in the constitution of the aqueous humor which blocks up the outlets. We have seen that this alteration in the fluids produces glaucoma after traumatism and in serous cyclitis, and Troncoso claims to have found an excess of albumen in eyes affected with chronic glaucoma." Bulson in a recent article (*Ophthal. Rec.*, Nov., 1907) accepts the same theory and states: "This being true, our treatment should be not only surgical to relieve the eyeball of intraocular pressure, but constitutional also, for the purpose of favorably altering the character of the fluids of the eye." Other conditions have been found which doubtless enter into the pathogenesis. Pusey of Chicago (*Knapp's Archiv.*, Mar., 1907) makes a pathological report on an eye removed during an acute inflammatory attack accompanying intraocular neoplasm and found that the pigment from the neoplasm had been deposited in the filtration angle along the course of the canal of Schlemm and along the emissary vessels and peri-

vascular lymph spaces involving the sinus venosus scleræ, but *no cells* found along the optic nerve pr venæ vorticossæ. He has found other reports in literature where the same pathological findings were recorded. The pigment of the iris and ciliary together with the exfoliated epithelium elements, which, after detachment, doubtless undergo swelling, makes a good sediment for blocking up the microscopic outlets. I have seen glaucoma so acute that the iris was rarefied, disintegrated and rendered so thin that red reflex could be seen through it similar to what is observed in albinos. Another recent view is that of Henderson of Nottingham (*Brit. Med. Jour.*, Nov. 2, 1907). He thinks glaucoma is induced by "a closure of the interspaces in the pectinate ligament in consequence of *fibrosis of the connective tissue stroma* and the formation of a homogeneous membrane around the fibrous bundles." It is barely possible that he has mistaken inflammation exudate secondary to the glaucoma process for primary fibrosis antecedent to the glaucoma. Erdman (*Graefe Archiv.*, July and Sept., 1907) set up a typical glaucoma in animals' eyes by the injection of fine granules of iron driven in the meshes of the tissues by electrolysis. The iron particles set up an inflammation of proliferating type in the cornea angle and glaucoma resulted. The eyeballs enlarged as in buphthalmos. It is self-evident that there was no angio-sclerosis in the animals which predisposed to the attack. Erdman demonstrated that the aqueous was rich in albumin in animals' eyes rendered glaucomatous by experiment.

A book on the subject, *Pathogenie du Glaucome*, by Terson of Paris, recently published, expresses a broad view on the subject of glaucoma. He asserts it may be stated broadly that glaucoma is not an isolated affection, but rather the localization of certain processes which affect the system as a whole (*Ophthalmoscope*, Mar., 1908, rev. by Henry Power). He says it is a local expression of a general disease just as syphilitic iritis is a local expression of a general affection. He further states that glaucoma in any form is an "œdema in a closed cavity," or one easily closed, hence the increased tension. "Glaucoma and increased tension must not be confounded. Hypertony is a symptom, glaucoma is not. Glaucoma is a syndrome of which hypertony is one of the symptoms." To prove this he cites the instance of glaucoma simplex where there is no tension, but where glaucoma is unmistakably present. Among the causes he mentions heredity, fatiguing and exciting occupations, gout, rheumatism and syphilis, and he claims that the proper constitutional treatment as indicated by these diseases when employed along with local treatment gives prompt results.

A study of remote causes or predisposing conditions or at least the preceding systemic conditions, comprises a long long list of diseases which includes nearly every chronic disease in the category. Terson lays the greatest stress on the diseases of the vascular system as furnishing the predisposing cause, such as cardiac disease, especially aortic insufficiently arterio-sclerosis and venous dilatations as expressed in hemorrhoids and varices. Particular attention is called to angio-sclerosis and especially in the ciliary processes as furnishing the likeliest cause and his view is that of many others who have preceded him from Stellwag, 1870, down to Parsons, 1907. How much the conditions known as uricæmia, acetonuria, indicanuria, auto-toxemia and perversions of the chemistry of the physiological juices of the body from poisons, bacteria and disease, producing, as Professor Fischer claims, "acid states of the blood," has to do with glaucoma, can only be conjectured. Theoretically anything which will damage the nutrition and elasticity of the blood

vessel walls in a person having large lenses and small eyeballs would lay the foundation for an onset of glaucoma.

Glaucoma is a disease of persons past forty years of age and more often, the aged. The study of the eyes of the aged is an interesting study in sclerosis. The cornea and sclera are thinned and hardened. The iris is stiffened, the pupil does not readily dilate admaximum, even with atropine very often. The lens is sclerosed so that it is nearly all nucleus. The ciliary muscle which has long ceased to functionate has nearly disappeared. The chorioid is affected to a certain extent, for we usually find floating opacities in the vitreous and the retina is obtunded, at least the vision and the visual fields show deterioration. Now add to this a diseased atheromatous state of the vessels induced by years of faulty diet, taints and dyscrasiæ, or some affection of the vascular system like acute cardiac hypertrophy, which vastly raises the blood pressure within the eye, sometimes inducing apoplectiform retinitis, and you have the background for the occurrence of glaucoma when the exciting cause comes along.

Regarding Professor Fischer's colloid theory for glaucoma, I can say there is nothing which he teaches which is in defiance to the above theories. He goes a mighty step further, however, and illuminates the dark chasm that stretched between former theories and known facts and supplies us the connecting link to complete the chain of argument which spans the gap.

The Society owes him a vote of thanks for his splendid contribution to our working knowledge concerning this dreadful malady.

DR. G. C. SAVAGE, Nashville, Tenn.:—To my mind this is one of the best papers to which I have listened in a long while. It has made every one of us think, and we will not stop thinking for awhile. He has given us more light on the question of glaucoma than we have ever gotten from all the books we have ever read or papers we have listened to. In saying this I am not complimenting a favorite friend, for I have never heard of Dr. Fischer before. If he doesn't like this he can retaliate that he has never heard of me. I venture that his mother has said to him, "You have too much curiosity," or his father, or some old maid aunt or uncle, has certainly said so. We know he must have industry or he could not be doing pathologic work. Industry coupled with curiosity brings things to pass. There are two things for which I am sorry: one is, he is not an oculist, and the other is that he lives across the Ohio river from Dixie. I am quite sure he must have been born in the South, or in some foreign country.

Not many years ago there was a paper read in which there were some strange things said. When that paper reached the publisher he said those things are empirical and the paper ought not to be published. One of the things advised was the subconjunctival injection of the citrate of sodium to relieve pain. I do not know why some one before Dr. Fischer has not thought of these things he has presented to us today, and the most wonderful thing about the things he has said is that they appear true. I can see how an attack of acute glaucoma might be relieved by the agents he has spoken of if we accept the narrowed zone as one of the causes. The ciliary body narrows it still more, and by relieving the œdema, the zone is enlarged and the pain and pressure disappear.

## THE CRYSTALLINE LENS AS FIGURED IN THE TEXT BOOKS AND AS SEEN IN THE EYE.

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It is ordinarily supposed that the crystalline lens occupies the ideal position represented in the text books, that the axis of the lens passes through the center of the cornea, and that the vertical and the horizontal diameters are exactly at right angles to its axis. Moreover, we usually take it for granted that during the act of accommodation the two surfaces of the lens become more convex, always in an equal and regular manner.

The object of this paper is to call attention to the fact that most of these assumptions are not warranted, at least not in the majority of what we call normal eyes. In showing this no pretense is made to strict originality. But in a considerable search it has been impossible to find any single statement of these facts which lie scattered through volumes of the Archives of Physiology or buried in the transactions of various societies. It seemed, therefore, that a single condensed statement concerning the position and action of the lens might be of some value, especially in view of the fact that in every test of the refraction a question may arise concerning some one of the points here referred to. This statement naturally divides itself into the consideration of four points, which are:

First—The appliance for viewing the two surfaces of the lens, or rather, the reflections from them.

Second—Formulae for calculating the position of the lens and the changes which its surfaces undergo during accommodation.

Third—What these calculations show as to the position of the lens and its changes under the action of the ciliary muscle.

Fourth—The clinical importance of abnormal positions or changes in the lens.

### I. THE INSTRUMENT FOR VIEWING THE REFLECTIONS FROM THE TWO SURFACES OF THE LENS, THE PHACOMETER.

The position of the lens in the living eye and changes in its curvature are determined as we know by studying the reflections of a light, from the cornea and from the two surfaces of the



lens. The appliance, simple or elaborate, for viewing these so-called entoptic images, has been named a phacometer. So we ought first to recall one or two forms of that instrument.

When Purkinge first studied these reflections he used only a magnifying glass. But very soon naturally a telescope was arranged to view them. Gradually this telescope acquired more addenda as the phacometer grew more perfect. We know that almost any ophthalmometer can be made to serve as a phacometer. For as the ophthalmometer is simply a telescope which has a double refracting prism in its tube, or an arrangement which corresponds to that, of course, if we take out these prisms we

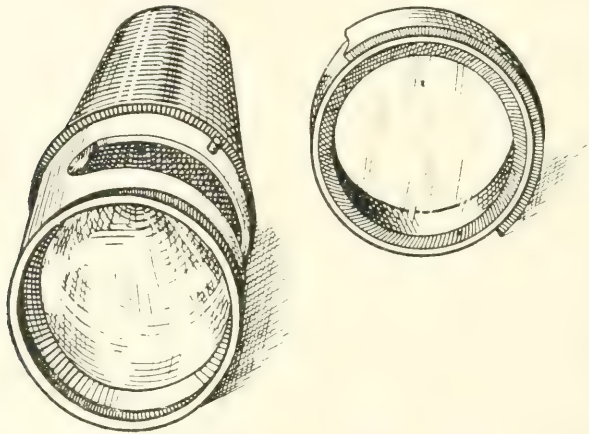


Fig. 1.—Arrangement by which the prisms can be removed from the Javal ophthalmometer, thus converting the instrument into a telescope for determining the position of the lens.

have the telescope. In the Javal Schiotz ophthalmometer it is particularly easy to do this (Fig. 1), as I have already pointed out in *Ophthalmology* of 1910, page 160. It is also necessary to attach a small electric light below the center of the tube and a point for fixation to one of the mires. For the latter the head of a small brass hat pin or button is the simplest and best. In other words, an excellent phacometer can easily be made out of the ordinary ophthalmometer (Fig. 2). It is desirable also to have the head of the subject firmly and comfortable adjusted in a head rest, the one which I have described in the *American Journal of Ophthalmology* of 1900, page 170, being very convenient for that purpose (Fig. 3).

With even this rough arrangement it is possible to measure with considerable exactness the number of degrees which a given



lens tends to tip outward or forward, as will be mentioned presently.

Among the other models which exist today perhaps the most complete is the one suggested by Tscherning and made by Ivan Werlein for the ophthalmological laboratory of Sornbonne at

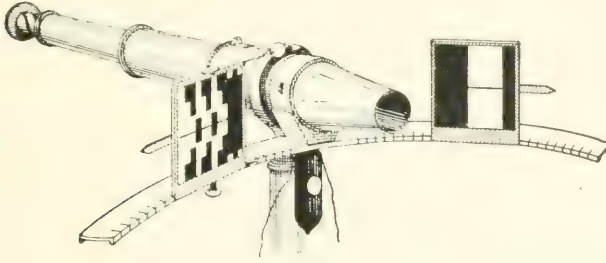


Fig. 2.—Arrangement of the Javal ophthalmometer when converted into a telescope with a light below and a movable point of fixation (a glass ball) above, for determining the position of the lens.

Paris. After being at that laboratory several years ago I brought back one of these instruments which is presented today. It is probably the only one in this country. A rough sketch of an earlier model can be seen in Tscherning's *Physiologic Optics*,

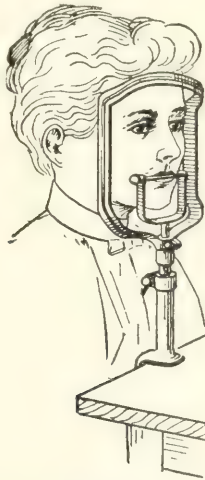


Fig. 3.—Ophthalmological Head Rest.

page 44 (reproduced in Fig. 4), and a photograph of the later model can be seen in my first volume on the "Muscle of the Eye," page 72. Having thus seen that the phacometer is the result of gradual evolution, and having glanced at one of the most com-

plete models of the instrument, we naturally ask ourselves how it is used.

The first step in most of the measurements is to determine the direction of the axis of the lens. That is to say the angle which the optic axis makes with the visual axis or visual line. As this is a comparatively simple procedure, we might consider that first.

It happens that at a meeting of this Academy two years ago

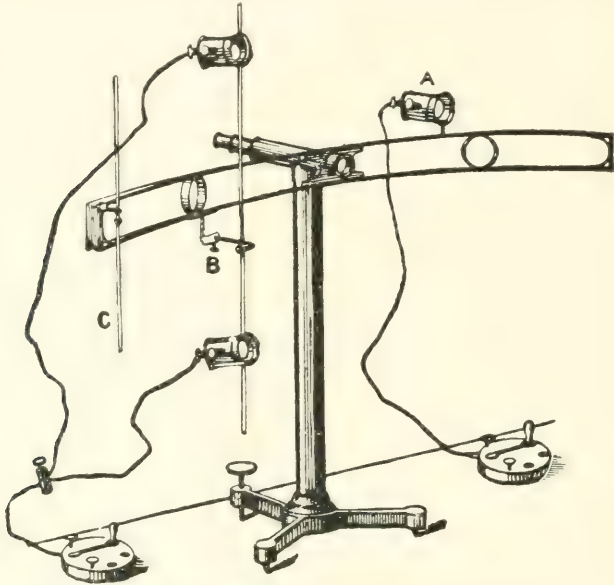


Fig. 4.—The Ophthalmophakometer or Phacometer.

I showed how easy it was to measure that angle. Repetition of details is now unwarranted. (See Transactions for 1910.)

## II. FORMULAE FOR CALCULATING THE POSITION OF THE LENS AND THE CHANGES WHICH IT UNDERGOES.

The point to which I would call attention and which is the special reason for the presentation of this paper, is a series of formulae for determining the position of the lens and its curvatures. These formulae give a clinical value to an instrument which before was suited rather to the laboratory.

Moreover, these are presented here apparently for the first time and a word of explanation is therefore necessary concerning them. Suppose a ray of light enters the eye, passing only through the cornea and aqueous and striking the anterior surface of the lens and is reflected from that point back out of the

eye. It is comparatively easy to trace the course of this ray, for we know that its refraction is in proportion to the index of the refraction of the air (one), divided by the index of refraction of the aqueous humor, or, of course, the reverse holds true when the same ray emerges from the eye.

When, however, we wish to trace a reflection from the posterior surface of the crystalline lens, we must calculate the refraction which the ray undergoes in passing. First, from the air into the cornea. Second, from the cornea into the aqueous. Third, from the aqueous into the crystalline lens, and then in the reverse direction. Evidently this process is slow and some-

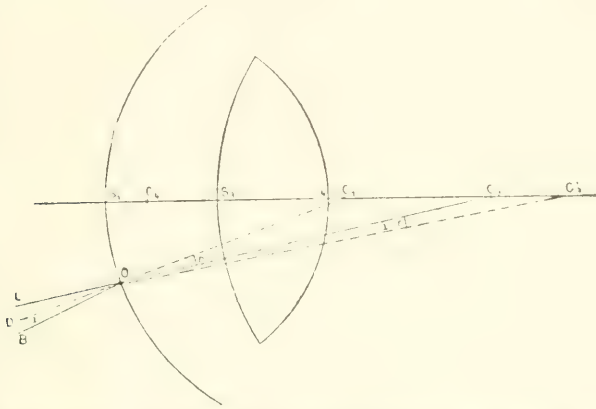


Fig. 5.—Diagram showing the refracting surface,  $C_1C_2C_3$ , and their centers of curvature,  $S_1S_2S_3$ .

what difficult. The principles upon which it depends will be found in the *Optique Physiologique* by Tscherning and elaborated in an article by him in the *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*. Later he simplified the process and reduced the calculation to four different formulae. These were for some time in use by the students in his laboratory.

It seems proper that with this explanation and without the least claim at originality myself, to present these formulæ here. The refracting surfaces to be taken into account are seen in Fig. 5. In this

$S_1$  is the anterior surfaces of the cornea and  $C_1$  its center of curvature.

$S_3$  is the anterior surfaces of the lens and  $C_3$  its center of curvature.

$S_4$  is the anterior surfaces of the lens and  $C_4$  its center of curvature.

The posterior surface of the cornea and its center of curvature need not be taken into account.

Also concerning the phacometer, for convenience of calculation, let us designate by:

A. The distance, in degrees, from the telescope of the one round lamp.

B. The distance, in degrees, from the telescope of the two lamps on the same upright by,

C. The distance, in degrees, from the telescope of the white ball looked at by the patient.

$R_1$  the radius of curvature of the anterior surface of the cornea  
7.829 or 8.

$R_2$  the radius of curvature of the anterior surface of the lens.\*

$R_3$  the radius of curvature of the posterior surface of the lens.

Then we will have the following formulæ:

(A) For the distance of this anterior surface behind the front of the cornea, that is, the depth of the anterior chamber. Profondeur or P we have:

$$S_1 S_2 \text{ or } P = R_1 \frac{A - B}{A - \frac{1}{4} B} \quad (1)$$

(B) For the distance of the center of curvature of this anterior surface behind the front of the cornea we have:

$$S_1 C_3 = R_1 \frac{C + \frac{1}{2} B}{C + \frac{1}{8} B} \quad (2)$$

II. For the posterior surface of the lens.

(A) For the position of this surface we have:

$$S_1 S_4 = R_1 \frac{A - B}{A} + 0.3 \text{ mm} \quad (3)$$

(B) For the center of curvature of the posterior surface we have:

$$S_1 C_4 = R_1 \frac{2C - B}{2C} + 0.2 \text{ mm} \quad (4)$$

In order to illustrate the clinical value of these formulæ it is well to give a few examples. It is difficult for the beginner to recognize the dull blurred reflection from the anterior surface of the lens, and until his eye is trained to look for it he often fails to see it even when pointed out. For that reason it is easier to commence with calculations which relate to the posterior surface of the lens, namely, those given by formulæ (3) and (4), Taking it for granted, however, that sufficient familiarity with

the instrument and with the images has been obtained, we may take these formulæ in order and proceed as follows: Suppose we find that the reflection from the anterior surface of the lens, of the single light, can be brought in a vertical line with those of the double lights when the arrangement on the arc is as follows:

$A = 28^\circ$ ,  $C = 14^\circ$ ,  $B = 19.4^\circ$ , then substituting in formula (1) we have:

$$S_1S_3 = 8 \left\{ \frac{28 - 19.4}{28 - 14.8} \right\} = 2.9 \quad (1)$$

as the depth of the anterior chamber.

In a similar manner, suppose we have an alignment of the images when the arrangement is as follows:

$A = O$ ,  $C = 6.6$  nasal side,  $B = 9$  temporal side, then substituting in formula (2) we have:

$$S_1C_3 = 8 \left\{ \frac{6.6 + 4.5}{6.6 + 1.12} \right\} = 11.5 \quad (2)$$

But from (1) we found  $SS_1$  depth of the anterior chamber = 2.9.

Now  $S_1C_3 - S_1S_3 = S_3C_3 = 11.5 - 2.9 = 8.6$ .

As regards the posterior surface of the lens, the calculations concerning these are easier still, for the reason that the reflections from that surface are readily distinguished even by the novice.

Finally, suppose we wish to ascertain the center of curvature of the posterior surface of the lens.

First—Let us place  $A$  at  $O$ .

Second—Let us place  $C$  wherever desired, suppose in the temporal side of left eye.

Third—Place  $B$  at point to bring the images  $xim$  the three reflections in a vertical line, then if

$C = 11.8$ ,  $B = 21.6$ , then (4)

$$S_1C_4 = 8 \left\{ \frac{23.6 - 21.6}{23.6} \right\} + 0.2 = 0.8 \quad (4)$$

But from (3) we have found  $S_1S_4 = 6.5$ .

$S_1S_4 - S_1C_4 = C_4S_4 = 6.5 - 0.8 = 5.7$ .

### III. THE RESULTS OF THESE MEASUREMENTS.

Having thus glanced first at the instrument with which the lens can be seen, and then at a few formulæ useful in measuring its position and its surfaces, we come now in the third place to



the results of these measurements. Much might be said on this point. Those who wish details are referred to the bibliography in my first volume on the "Muscles of the Eye." Also to articles in the *Journal de Physiologie et de Pathologie Generale*, by Besio, July and September, 1901.

But it may be said briefly:

First, as to the position of the lens: It is very seldom in the ideal position shown in the text books, because:

(A) The anterior end of its axis points slightly temporal-wards.

(B) The anterior end of that axis also points usually somewhat downward.

Second—During accommodation the entire lens apparently moves slightly downward.

Third—As to the changes which take place in the two surfaces of the lens during accommodation:

(A) The posterior surface as a whole changes but little. This increase in its convexity, though slight, is quite regular.

(B) The anterior surface of the lens as a whole does change, and to a very decided degree. The curvature is not regular, but the central portion assumes a kind of conical projection or bulging forward. This is not a matter of theory, but is the result of measurements as were shown by Besio in 1901 in the *Journal de Physiologie et Pathologie Generale*.

(C) The curvature of parts of the posterior surface change irregularly as compared with other parts. This perhaps is also true of the anterior surface, but the relative position of the blurred reflection from this surface cannot be seen so clearly with any phacometer thus far made.

But with any such good telescope if the small bright reflex from the posterior portion of the lens is observed in a certain position, with the accommodation relaxed, then, when accommodation begins that point also begins to move. If that posterior capsule of the lens changed its curvature in a regular manner, we would naturally expect the reflection from that surface to pass from the starting point to its halting point, in a straight direction, or at least to follow a regular curve. But such is not the case. When the eye is at rest, these reflections from the posterior surface being at one point, then as accommodation increases that reflection moves often in quite an irregular curve. These irregularities seem to be constant in the same eye, but quite different from each other in different eyes.

Attention was called to this long ago, and in *Tscherning's Physiologic Optics* several figures are given showing the irregular course taken by these reflections, as they are seen with the phacometer. The exact causes of such changes are not well understood.

#### IV. CLINICAL IMPORTANCE OF THE MAL-POSITION OR OF IRREGULAR CURVATURE OF THE LENS.

It is evident that any displacement or irregularities in the surfaces of the lens will produce a certain amount of astigmatism. This was long ago recognized as lenticular astigmatism.

It is true that the astigmatism produced by displacement is usually only of a slight degree, probably not exceeding 0.75 diopters in most cases.

But evidently the important point is that displacement or especially the varied and unequal changes in the surface call for correspondingly varied and unequal demands upon different portions of the ciliary muscles. Concerning this general proposition there can be no doubt.

When we advance another step, however, in this clinical part of this study, and ask just what irregularities in the position or in the changes of the lens, correspond to certain clinical symptoms, it must be admitted that the observations thus far are too few and unreliable to warrant any very definite conclusions.

It would be easy to advance a considerable list of theories. But we have already too many theories concerning not only the ciliary but also concerning all the other ocular muscles. What we need is facts. We need men who will equip themselves with phacometers like that of Tscherning, or even such can be made by modifying ophthalmometers now in use, and have these men take the time to carefully study the changes which take place in those images during the act of accommodation in normal and in abnormal eyes. Already a number of notes have been made which indicate that this subject is of very decided clinical importance in relation to those, as yet undefined symptoms, called asthenopia. But those notes are not yet sufficient to warrant definite conclusions. A paper like this is quite long enough if it only attempts to indicate the instrument with which the observations are made, the formulae for making the calculations, the results obtained, and a mere glance at the clinical value which such observations have.

Some practitioners are still living who can remember when the ophthalmoscope or the clinical importance of the extra-ocular muscles were considered vain novelties. It seems probable that our views will also change concerning the phacometer and the clinical importance of the intraocular muscles.

#### DISCUSSION.

DR. G. C. SAVAGE, Nashville:—Personally I am very glad that Dr. Howe has called attention to the tilting of the lens. That the lens tilts in some eyes and must remain tilted goes without saying. That it tilts and does not remain so throughout life is also true. When it is tilted there is lenticular astigmatism. Suppose we have a cornea free from astigmatism as shown by the ophthalmometer. Then if there is no total astigmatism the lens is not tilted. If there is no corneal astigmatism and there is a total astigmatism, the lens is tilted. If there is corneal and no total astigmatism the lens is tilted. To make myself understood, the tilting of any lens 45 degrees on any axis doubles its refraction power, at right angles to the axis of tilting. No human lens can tilt that much, but a slight tilting can cause a deal of lenticular astigmatism.

What is it that tilts the lens? Static tilting is one thing and dynamic tilting is another. There are some eyes in which the lens is statically tilted and it will remain thus forever. There are others in which the tilting is dynamic. What is the source of this power? If we have a corneal astigmatism of 1 D. and there is no total astigmatism, and the greatest meridian of corneal astigmatism is vertical, then there has been a tilting of the lens on its vertical axis, which perfectly neutralizes the corneal astigmatism. The axis of tilting is always in the plane of the meridian of greatest curvature. If that is vertical, the tilting of the lens is on its vertical axis. In order to produce 1 D. it does not have to tilt much. There is only power that can do it, and that is in Bowman's muscle of the ciliary body. It has the power of tilting in this direction and that, but not far. There is often much dynamic lenticular astigmatism. Bowman's muscle is composed of radiating fibres, and is doubtless innervated by the superior cervical sympathetic ganglion. Muller's muscle is circular and supplied with third nerve fibres. When we have an astigmatism, and the dilatation of the pupil reveals it, that astigmatism had been overcome normally by means of Muller's muscle simply regulating the focal efforts. In such cases, as previously shown with Muller's muscle paralyzed, you can produce the same acuteness of vision with the trial spherical lens which place the two foci equally distant from the fovea. But there is not a power in the whole *materia medica* that can have one particle of effect on Bowman's muscle. I hope some one will discover something that will put at rest Bowman's muscle, as homatropine does Muller's. Then we can sit down with confidence after both have been used and perfectly correct every astigmatic eye. Dynamic lens tilting does not occur in all cases; my own lenses for years were tilted so as to correct  $2\frac{1}{2}$  D. of corneal astigmatism. They are not tilted today, for I am compelled to wear  $2\frac{1}{2}$  D. cylinders, which fully correct my corneal astigmatism. I had my pupils dilated time after time, trying to get full relief from the asthenopia, but the astigmatism would not uncover itself except by degrees under homotropine it uncovered a little more than before the mydriatic was used, simply because the forced interval was disturbed. But years piled up, and as they

accumulated Bowman's muscle became tired of tilting the lens and finally could do it no more, and today my own crystalline lens does not correct any of my astigmatism. First it corrected all, then  $\frac{3}{4}$ , then  $\frac{1}{2}$ , then  $\frac{1}{4}$  and so on, and finally the whole of astigmatism showed itself.

The static tilt of the lens is another thing. I believe people are born with the lens displaced. If they are, and there is no corneal astigmatism there always will be a total astigmatism. It is to be corrected by the trial lens, but that astigmatism is absolutely lenticular. A word, in closing, as to the angle gamma. There is no angle gamma in the ideal eye, and the more nearly the eye is ideal, the less is the angle, and vice versa. This angle when it exists is formed by the visual axis and that indirect visual line which happens to cut the center of the corneal curve. Helmholtz' optic axis, except in the ideal eye when it is the visual axis, is a myth. In all eyes the visual axis is the optic axis and no other line than the visual axis can be the optic axis. The angle gamma is the angle formed at the center of rotation by the intersection of the visual axis and that indirect visual line which happens to pass through the central point of the corneal curve.

DR. HOWE (closing discussion):—Our friend Dr. Savage has given us an interesting and rather weird account of what takes place in his own eye. With theories I have nothing to do. I simply call attention to the instrument, and to the observations taken with it. These demonstrated, without a shadow of doubt, that the optic axis and the visual axis are not the same as he has contended, but that they intersect at an angle.

ONE YEAR'S EXPERIENCE WITH SALVARSAN.  
BEING A REPORT OF 230 INJECTIONS, WITH  
SPECIAL REFERENCE TO EYE AND EAR  
COMPLICATIONS.\*

B. C. CORBUS, M.D.

CHICAGO, ILL.

It is now two years since Professor Ehrlich sent Dr. Konrad Alt some salvarsan for the treatment of syphilitic paralytics, and just one year this month since the Rockefeller Institute received its thousand doses to be distributed in this country for experimental purposes.

The questions regarding salvarsan then are the same as now, namely these:

1. Is it an absolute specific for syphilis and does it produce a *therapea sterilisans magna*?

2. Are there any severe organotropic effects?

The time has been sufficiently long for us to draw some fairly definite conclusions, but as regards the final solution of the problem we must be content to wait for many years.

Already there have been over 60,000 cases treated. The literature is voluminous, mostly from abroad. This is explained by their excellent hospital and clinical facilities.

Those of you who have watched the reports of the application of this remedy must surely agree with me that salvarsan, if properly applied, is the best aid yet devised to combat syphilis.

Here and there in the German, English and American literature we read adverse criticism that comes from the pens of those who have had little experience, or else, for various reasons, they are not willing to concede salvarsan its merits.

In the literature in this country, it is indeed encouraging to read the beginning of Dr. John A. Fordyce's article, which says: "A more extended experience has not altered my views regarding the value of salvarsan; on the contrary, I am more and more impressed with its extraordinary therapeutic qualities." Also encouraging is the opinion of Faxton Gardner, who says: "Salvarsan has come to stay. Despite all, it is

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\*Read by invitation.



the most powerful agent we have at our disposal against syphilitic manifestations." Still more encouraging is a circular from the U. S. War Department, under date of June 3, 1911, authorizing the use of salvarsan in the army, signed by Surgeon General Towney and approved by the order of the Secretary of War. This indeed is the sentiment of all of us who have had any experience at all with the new remedy.

In answering the early question, does salvarsan produce a sterilisatio magna, we can say that experimentally in rabbits it does, but therapeutically with the dose 0.6 grams it does not.

That it does not produce a sterilisatio magna is indeed a blessing, for if it did, it would belittle the infection to such a degree that venereal diseases, instead of becoming less frequent, would increase fifty-fold. As early as the summer of 1910, numerous cartoons and articles appeared in the foreign lay press calling attention to and symbolizing the ease with which syphilis could be cured.

Concerning the second question, we can safely say from the reports of all the cases treated that there are no general organo-tropic effects in properly selected cases.

In an address to the Vienna Society of Physicians, November 18, 1910, Finger expressed some doubts whether the assertion that salvarsan was entirely harmless was justified in view of some of his disagreeable personal experiences in sensory nerves, particularly the optic and auditory nerves. Finger refused to explain the phenomena observed, claiming that it was too early to form a decided opinion, but he called attention to the fact that such phenomena occurred rather frequently and in an unusually early period of lues in patients who are still in the primary stage of the disease. He considered it less likely that these cases were independent syphilitic relapses, such as would have occurred without salvarsan, because of:

1. The possibility of a direct connection of such symptoms with salvarsan.
2. The possibility of a combined action of salvarsan with lues, in the sense that the remedy created a locus minoris resistentia in which the lues can be localized.

Schamberg, May 20, 1911, reported in the American Medical Journal all the literature to date in an exhaustive article,

citing Finger's cases of optic nerve disturbances and adding reports from Blaschko, Rille, Held, Oppenheim, von Zumbusch and Fordyce.

In the same article he adds Finger's reports of auditory nerve disturbances, also Rille, Kern, Urbantschitsch, Matzenauer, Rusch, Alexander and others.

Werther says that the frequency of such "neuro-relapses" in salvarsan cases is somewhat greater than the proportion to the number of syphilitic cases in general.

Risson is astonished that in a small series of patients he observed two cases of optic nerve atrophy.

Bettmann insists that these neuro-relapses appear earlier and more frequently than has seemed to be the case before salvarsan.

Stern and Waltenhoefer consider their cases toxic.

Port thinks that the increased number of such cases makes it little probable that we have to deal simply with relapses, and we must rather assume a toxic injury to the nervous tissue.

Geronne and Gutmann agree with Finger when they say that the number of such neuro-relapses has increased essentially since salvarsan was introduced, and that the time of the relapses almost without exception has advanced to an early stage. "If in about three hundred cases treated with salvarsan, thirteen neuro-relapses occur, and if these appear mostly four to five months after infection, and six to eight weeks after salvarsan, we have evidently something new in the pathology of syphilis which must be brought into causal connection with salvarsan treatment." Nevertheless, these authors accept Ehrlich's view concerning the neuro-relapses.

J. Benario was able to prove that the affections in the cerebral nerves observed by the above authors have appeared exactly in the same way under mercury and potassium iodide.

Benario claimed that this settled a part of the question of harm with which salvarsan was charged.

At this date, Ehrlich gave the plausible explanation of these phenomena by saying that he considered these forms of the disease as neuro-recurrences of foci, because during the sterilization of the organism some spirochetes had not come under its influence. This in the first place is true of the spirochetes which had settled in the nerves passing through narrow bone channels. These are then principally topo-

graphic, anatomical conditions by which are caused the symptoms on the part of the cerebral nerves.

Benario has used all possible means to collect the reports of all the cases of the affections of the cerebral nerves known since the first publication. In this way he has disposed of one hundred and twenty-six single such observations, which occurred in at least 14,000 treated cases.

To complete his reports he sent letters to a majority of the authors with a question sheet. From the replies he obtained an abundance of material which permitted a general and convincing exposition of the conditions to be considered.

In Benario's question sheet he considered the optic and auditory nerves separately—each in regard to vocation, abuse (such as alcohol and nicotine), through previous ear disease and also whether a previous injection of some other form of arsenic had been given. Numerous other questions were asked, tending to throw side lights on previous optic or auditory disease.

These reports show that the early secondary stage is particularly predisposed to these neuro-recurrences. He calls attention to the fact that in extragenital primary lesions, especially cephalic chancres, involvement of the nervous system is prone to follow.

They occur from a single spirochete focus which had remained from the principal mass at sterilization. This view is further confirmed by the fact that recurrences are found almost exclusively in cases of secondary syphilitics of from two to eight months standing, where it is well known that a colossal distribution of spirochetes exists.

This is substantiated by the following clinical reasons:

1. Long interval between injection and appearance of nervous manifestations.
2. From the nature of the pathological process itself, which shows a condition of irritation and inflammation in contrast to atrophic processes observed after other arsenicals.
3. From the fact that the disease appears almost exclusively during a definite period of syphilis.

Benario says that it is not fair to charge all recurrences to salvarsan, as we do not realize that the neuro-recurrences occur many times in mercury treatment. Also that we are watching all cases now with greater scrutiny and with a far greater degree of intelligence, knowing well the history of

arsenical preparations, and especially since Ehrlich had warned all observers in regard to the possible neurotropic effect of salvarsan.

Benario calls attention to the fact that we must be especially watchful of recurrences in the following classes of cases:

1. Recent secondary states.
2. Extragenital and cephalic chancres, due to immediate proximity to the nervous system.
3. Character of the skin phenomena which are severe from the start.
4. Headaches (invasion into the central nervous system by spirochetes).

The above symptoms should be a warning to give energetic treatment.

He believes that by thus instituting a vigorous treatment with both salvarsan and mercury many neuro-recurrences will be eliminated.

It is true, no doubt, that there are a few limited cases where salvarsan has been productive of harm, but when we consider the enormous number of cases treated and the equally great number of physicians that are administering salvarsan, we wonder that there are not more complications.

There is no doubt that the neutral suspension as recommended by Wechselmann has been productive of toxic symptoms, for here the coagulum in some instances has remained in the tissues for months; again careless technique in preparing the alkaline solution, for intramuscular and intravenous administration, both in regard to sterility and excess of sodium hydrate, may be productive of harm.

Therefore, before we condemn a substance that has fewer neuro-relapses than there are complications following the administration of chloroform, let us look closely to our technique and have a care that we are perfectly competent to administer the substance.

#### INDICATIONS.

At the present writing salvarsan is indicated in every case of recent syphilis as the first and most efficient therapeutic agent at our disposal, and in every case where quick action is desired, except in disease of the cardio-vascular system, where it is not possible to obtain a sterilisatio magna, it is

possible to obtain a clinical sterility with one dose, rendering those patients for the time clinically free from their disease germs.

No doubt we could treat the early cases entirely under a salvarsan therapy, but we are not justified in using this exclusive method, especially since salvarsan is a new therapeutic agent and we have such a recognized ally in mercury.

From now on salvarsan should be the mainstay of the syphilographer. What its results will be in internal medicine and nervous diseases of syphilitic origin it is not possible to prophesy at present. At best our results cannot be brilliant, as here we have as a rule considerable degeneration of the nervous and cardio-vascular system.

In *tabes dorsalis*, if of only recent duration and accompanied by a positive Wasserman, cessation of further symptoms is possible if the treatment is carried out vigorously by the combined method.

What its scope is in ophthalmology, we are not able to tell, as many cases of eye syphilis were in the beginning refused treatment, fearing a neuro-toxic effect of salvarsan. But the administration of salvarsan in syphilitic eye lesions is no longer prohibited. In optic atrophy it is impossible to change the condition by any therapeutic agent once the process has occurred. Care should be used in following up treatment with salvarsan where other arsenicals have been used to any extent, as here a toxic effect caused by previous applications might be laid at the door of salvarsan.

Ehrlich's animal experiments indicate that the drug does not exert injurious by-effects upon the optic nerve as does atoxyl and the related preparations of arsenic.

J. Igersheimer considers as the reason for this that salvarsan is not split up in the body into derivatives of phenylarsenic acid, as is the case with atoxyl.

Hoppe's investigations showed that salvarsan has only a slight chemical affinity for the nerve tissues, for after three days he could not find any arsenic in the brain, spinal cord or optic nerve.

As to the eye, clinical reports vary in their tenor; the number of contributions on this subject is considerable and Steindorff has recently presented an excellent paper embracing reports on over seven hundred cases on which he bases the following conclusions: He finds that blindness referable exclusively to salvarsan has so far not been definitely deter-



mined by anybody. The remedy has a favorable effect in primary and tertiary affections of eyelids and conjunctiva, but it cannot arrest the atrophy in pemphigus. In specific dacryocystitis, scleritis, gumma corneæ, in luetic diseases of the orbital bones, salvarsan has rendered good service, at least in the small number of cases observed so far.

Parenchymatous keratitis due to acquired lues reacts almost always promptly to salvarsan. In the treatment of parenchymatous keratitis due to congenital syphilis, failures are more frequent than successes. Nevertheless the remedy can shorten the courses of promptly treated cases. In unilateral disease it is only rarely possible to protect the healthy eye.

Neuritis, especially if treated early, reacts almost always, and rapidly. It is true that the success is sometimes only of short duration and that relapses are frequent.

For the treatment of sympathetic inflammation of the eye, salvarsan does not appear to be the proper remedy so far as can be concluded from the small number of cases observed up to date.

Affections of the chorioid and retina are frequently influenced favorably, but sometimes new processes are observed immediately after injection.

In the treatment of inflammation of the optic nerve, respectively, of choked disk, the favorable results of salvarsan predominate. For atrophy of the optic nerve, salvarsan cannot be expected to do anything.

Pareses of the eye muscles are influenced favorably and promptly, but failures are just as frequent. Argyll-Robertson symptom and anisocoria are unaffected in the majority of cases.

In the treatment of syphilitic eye disease, salvarsan merits attention, especially in combination with mercury and iodin, and in such cases in which a rapid effect of anti-syphilitic treatment is of importance.

#### DOSE.

The dose practically remains the same as at first established, viz., 0.5 gm. for women and 0.6 gm. for men. However, in women I have frequently varied the dose according to the weight, giving frequently as much as 0.6 gm., and in many, especially in extremely debilitated cases, less than 0.5 gm.

Salvarsan can now be obtained in 0.1 gm. ampoules. This is valuable when the substance is to be administered to chil-

dren, as it insures an exact dose and prevents waste of the product.

I am not in favor of fractional doses in adults, except, perhaps, in syphilis of the cardio-vascular system, as here the dose must of necessity be small in order not to produce any untoward effects.

In primary, secondary, tertiary and in latent syphilis, I believe the best results are obtained from the largest dose that can be given with safety.

As salvarsan acts in two ways, viz., chemo-therapeutically and sero-therapeutically, we can readily see that if we give a sufficiently large dose of salvarsan and have a large number of spirochetes to combat, our endo-toxins will be greater after a large dose than after a smaller one, and in turn will work a greater curative effect in the disease than a smaller dose.

#### TECHNIQUE.

The intravenous method has become almost universal on account of its ease of application, the brief inconvenience to the patient, and his rapid recuperation. However, no one method should be used to the exclusion of others. This is borne out by experience, as in the early cases it is more advantageous to administer the salvarsan intravenously and later to inject it intramuscularly.

For the successful carrying out of the intravenous method, some form of gravity apparatus is preferable, and the more simple of these give the best results.

The method of administering normal saline before and after the salvarsan is recommended only to those who have little experience. Great care should be used to have the saline solution absolutely sterile and prepared fresh immediately before using, as numerous reports have appeared showing a febrile reaction following the injection, which was eliminated entirely by using great care in preparing the salt solution.

From the beginning I have not used normal saline solution.

A. The method of dissolving the solution in glass cylinders is vastly superior to the mortar as they are so easily kept sterile. The addition of hot water greatly facilitates the putting of the salt into solution and does not in any way deteriorate its action.

B. With a two-way cock attachment it is easy to find when

one is in the vein. If by chance one has missed the vein the sharp stinging pain and sudden swelling at the point of puncture warns one that he has not been successful. It is an easy matter to stop the solution at once and seek a new point of injection. The resulting extravasated salvarsan, if not too copious, is quickly absorbed without much effect.

In preparing the solution for the alkaline intramuscular method I now use a 2 per cent solution of sodium hydroxide, giving the injection in the same location as recommended in my previous article. (A. M. A. Jour., Sept. 3, 1910.) The method of injecting subcutaneously or intramuscularly in the muscles of the back should be severely condemned. Some of my patients that were injected nine months ago in this way still show large nodular masses.

Immediately after the intramuscular injection of the alkaline solution I apply hot applications. These are continued for forty-eight hours. The resulting induration and subsequent pain are greatly lessened thereby. All of the alkaline intravenous or intramuscular injections are given in the hospital; except in the severe manifestations the patients are detained only twenty-four hours after intravenous and forty-eight hours after intramuscular injection.

*Oil Suspension Method.*—For the large number of clinical patients who cannot afford to go to a hospital, this offers a fair substitute for either the intravenous or the intramuscular injections. The method I am using is as follows:

**Materials:** A large glass mortar and pestle, an all-glass syringe holding 5 c. c., one needle  $1\frac{1}{2}$  inches in length, 17-gauge.

The needle and syringe are placed in a large test tube with cotton in the bottom of the tube and stoppered with cotton. All the materials are placed in a dry sterilizer and sterilized just before using. Great care should be used to keep all water away from the materials, as the salt on contact with water quickly forms a hard sticky mass that clogs the syringe so that it cannot be injected.

*Technique.*—File the ampoule that has been previously sterilized and pour the salt into the mortar. Add about 2 c. c. of 10 per cent iodipin. This is rubbed in thoroughly until a smooth emulsion is obtained that is sufficiently liquid to be drawn up into the syringe. This is drawn up and 1 c. c. of iodipin is added, rubbing this up, and this in turn is drawn

into the syringe. Then, if there is still any salt remaining, a still smaller quantity of iodipin is added and rubbed up. In this way all the salt can be incorporated with the oil; when completed the syringe should hold about 4 c. c. of the finished emulsion.

The site of injection (outer quadrant of the buttock) is disinfected by painting with iodin.

The needle is thrust in and allowed to remain in situ for a minute to see that no vessel is punctured. The connection is made and the emulsion injected, the whole amount being placed in one side. Care should be used to force all of the emulsion out of the needle (by disconnecting and injecting a little air), as any of the fat may produce a necrosis.

Always cleanse the needle and syringe well with ether (do not use water).

The immediate pain after the injection is only slight and there is no shock.

How well this emulsion is absorbed will depend upon the thoroughness with which it is triturated. Clinical results with symptoms have been most gratifying in some of my cases.

However, on account of its tendency to become encysted, I prefer the other methods.

#### PROGNOSIS.

With an experience of one year with salvarsan in 130 cases one can begin to draw some definite conclusions.

Never in the history of medicine has there been a definite specific that has come into universal use, and has, except for a few instances, held its own so well. The more one sees of its remarkable clinical and biologic effects, the more satisfied he is with having used it.

It has come to be the right arm of our therapeutic force and combined with mercury it works with a swiftness that is truly wonderful. This is especially manifested in primary, secondary and tertiary lues.

The prognosis depends upon our making a prompt diagnosis, for nothing can be so disastrous to a syphilitic as a delayed diagnosis. Here days of procrastination may mean months of treatment.

It is so simple to treat the disease at the chancre period, before there is a positive Wassermann present. At this time

the first known collection of spirochetes comprise the primary lesion. Comparatively few have escaped into the system.

If we bend every effort to make a diagnosis by finding the organism either by the dark field illuminator or india ink stain and apply our treatment vigorously we can limit our disease to a few months instead of years.

There is a time-honored idea that it takes many years to cure syphilis and that we must of necessity spread our treatment out over a long period. As a matter of fact, the duration of the disease is in inverse proportion to the vigor and energy of treatment. The more emphatic the treatment, the quicker the cure.

I still believe that if we could get a sufficiently large dose of salvarsan and see our primary lesion sufficiently early a *therapia sterilisans magna* would be possible.

At first we thought salvarsan was limited to the so-called mercury-fast spirochetes, and those of a severe grade. Yet if it can work wonders here, pray why could it not do equally as well at the incipient stage of the disease.

Now the Wassermann is positive in direct proportion to the length of time of the presence of the primary lesion. In other words, it is usually negative when the chancre makes its appearance and remains so for a short while. As we approach the third week it begins to become positive, and after this it is practically always positive.

Here, then, are almost three weeks in which to make a diagnosis. I earnestly beseech every one to realize the seriousness of the disease and to recognize how simple it is to eradicate the dreaded infection if treatment is instituted early.

#### COMPLICATIONS.

Since its introduction into general therapeutic use, many complications have occurred, far more than have been reported; but, on the other hand unquestionably some have been reported which never should have been, as many of the complications are fatalities due to the operator and to a general lack of knowledge of the new therapeutic agent.

In the American literature little has appeared in the way of complications and fatalities. In a communication issued May 16, from the Ehrlich Institute, 18 fatal cases are reported following the use of salvarsan. All patients suffered from cardiovascular disease. As a consequence any patient suffering from



aortitis, coronary sclerosis and endocarditis should not have the treatment administered.

A routine examination of the urine should always be made prior to the injections, as a nephritis may be augmented by the treatment, from the reports of the literature this is a common occurrence. To be sure, if the nephritis is of a syphilitic nature it may be greatly benefited, as in a case reported by Nador.

The great question of whether salvarsan is toxic to the nervous system, especially the nerves of the eye or ear, has been fairly well answered by Benario, to which reference was made in the early part of this article. Undoubtedly the controversy will continue for some time before the subject is settled to the satisfaction of all. In the meantime we are watching all cases very closely, especially in regard to nervous manifestations, both before and after treatment, deriving from this close observation many points that have hitherto gone unnoticed.

Here and there in the literature an unfortunate complication or death is reported of some case that seems to have a special idiosyncrasy for the substance. This may follow large doses of any therapeutic agent, and not too much weight should be attached to it.

Abscess and induration are the common complications. These are absolutely avoided by the intravenous injection and can also be avoided after intramuscular administration, if strict asepsis is carried out and if the injection is placed in the gluteal region and contains no excess of alkalinity.

The method of dissecting out the vein should be condemned as it is needless and superfluous, tending to complications.

A periphlebitis may occur from a careless and improper technique but should not prove alarming. Continuous hot applications facilitate rapid absorption.

Except for two cases of abscess previously reported and three cases that developed a periphlebitis, in 230 injections I have had no unfavorable results.

I have repeated the injection as high as five times in one individual in two cases four times, in many cases three times.

I have had the eyes examined religiously both before and after treatment and up to the present time I have not observed any unfavorable complications.

## THE MANAGEMENT OF SYPHILIS AFTER THE BIOLOGIC METHOD.

Soon after the introduction of the Wassermann reaction it was realized that here at last was a tangible guide in the management of syphilitic cases.

Attention was called to this fact by Hoene, Boas, Pirkhauer, Schaltz, Jaseneck and Megrowsky, and by myself in this country in a paper read before the American Medical Association in 1910, being a preliminary report on fifty-seven cases treated with mercury from the standpoint of the Wassermann reaction.

It is now three years since the observations were begun and the possibility of such a form of treatment is no longer problematical; in fact, it is the method recommended by Ehrlich as the only rapid and reliable means of curing syphilis. The efficiency and practicability of the method is recommended by Gavini, Marcus, Letulle, Stumke and others, who are the most recent writers upon the subject.

Under this form of treatment our aim should be to make a diagnosis as soon as possible and then to begin treatment at once. If we are fortunate enough to begin treatment with a negative Wassermann, so much the better for the patient; if we are so unfortunate as to begin treatment with a positive Wassermann, we should bend every effort to get a negative Wassermann as soon as possible, and maintain it for at least one year. Many observers think that no matter what the stage of syphilis present, one salvarsan injection will be followed by a negative Wassermann. This depends upon two things, namely:

1. The stage at which the disease comes under observation; and
2. The amount of previous mercury treatment.

Few observers realize that it takes an extremely energetic form of mercury treatment to change a positive reaction to a negative in a case that has a moderately severe infection.

It is true that many recurrences have been reported following the injection of salvarsan. This is not at all surprising when we consider what we are attempting to do.

Compare the spirochetes in a patient's body to a room full of flies. Say the room has 500 flies in it and we kill off all but ten. The feeding is good. The room is so large that they are not observed; we think all are destroyed, we close the room and go away for three months. Upon returning we are

surprised to find the room as full as it was at the beginning.

To have a patient come under treatment and receive one salvarsan injection and to wait for developments is a fatal mistake. If we wish to eradicate his infection we must continue our treatment energetically either with salvarsan or mercury or the two combined, or else we will have a rehabilitation of the body by the spirochetes, for a patient that has a positive Wassermann with clinical manifestations of his disease is just as infectious as he was the day he manifested his primary lesion, no matter if it is ten years after the primary infection. The fact is, he is in a worse condition, for at this time the organism, to use Fournier's words, are anchored in the tissues.

#### THE COMBINED TREATMENT.

Fortunately for the syphilitic, salvarsan and mercury work like twin brothers. No matter which one leads or follows, they work with equal efficiency, though salvarsan is, of course, the more powerful agent.

We have three recognized ways of giving mercury: Rubbings, injections, and internal.

The method that I have adopted has been rubbings in conjunction with salvarsan.

Of the different forms of mercury I prefer the mercurettes of Parke, Davis & Company, both for the convenience as regards dose and application, and also for the slight tendency to produce a dermatitis.

Kromayer, several years ago, devised a mercury mask to be worn at night, basing his idea upon the fact that nurses working in wards where patients were rubbing mercury became salivated. Unfortunately, this mask did not prove practical.

By having my patients rub all their mercury on the chest and back, and keeping a thin gauze shirt on as long as possible, I believe I get both an inhalation and absorption treatment, as surely some of the mercury is volatilized at the body temperature, and the longer the shirt is worn the nearer it approaches the one-time popular mercury pad and becomes a veritable storehouse for the mercury.

I have my patients rub every night; if they desire to take a morning bath I have no objection, but they are instructed not to rub off the mercury. However, twice a week the skin is cleansed with soap and water in a warm bath.

In some hands the injection treatment offers the most con-

venient and best method of carrying out the combined treatment.

The pill treatment is only mentioned to be severely condemned. It gives the patient a false sense of security and is anything but short of criminal. From a serological standpoint, basing my views on almost one thousand Wassermann examinations, this form shows the greatest number of relapses.

#### WHEN IS A GIVEN PATIENT WELL?

At the present time this question is not easily answered.

No matter what the stage of the infection, primary, secondary or tertiary lues, our aim should be: "Get a negative Wassermann in the shortest time possible, but once we get to the negative goal, do not stop treatment short of one year; if we do we may have a relapse."

In all my cases, as soon as I have attained my goal, I insist upon giving at least one hundred and fifty rubbings and two intravenous injections of salvarsan.

#### REPORT OF CASES.

All of the following cases have been treated from the standpoint of the Wassermann reaction, regardless of any clinical symptoms. They comprise the following:

1. Chancre.
  - a. Before the Wassermann was positive. One case.
  - b. After the Wassermann was positive. Four cases.
2. Early secondaries. Twenty-three cases.
3. Late secondaries. Thirty cases.
4. Latent. Forty-four cases.
5. Tertiary. Three cases.
6. Syphilis of the nervous system. Nineteen cases.
  - 1-a. Before the Wassermann was positive.

This case came under my observation May 1, 1911, two days after the primary lesion appeared. Wassermann still negative. He received an intravenous injection of 0.6 grams; the local lesion was destroyed. In five days he received an alkaline intramuscular injection of 0.6 grams. During May and June he rubbed sixty mercurettes, rubbing one every evening. July 1 he received a third injection of 0.6 grams intravenously and July 17th he received a fourth injection of 0.6 grams intravenously.

The treatment in this case I consider to be ideal. It is an intense form of the combined method. We had a maximum

amount of treatment for a minimum infection, with the great advantage of beginning treatment at the earliest possible moment.

The patient, based upon my previous Wassermann experience, I consider to be well of his disease forever, but to be absolutely sure I will make the Wassermann examination from time to time during the rest of the year.

1-b. After the Wassermann was positive. In this series there are four cases.

The first case was reported in February in the Journal of the American Medical Association with picture. November 3, 1910, he received 0.5 grams in alkaline solution intramuscularly. November 28 the Wassermann was negative. December 12, 1910, a second injection of 0.6 grams in alkaline solution intramuscularly was given. He maintained a negative test for ten months, the last August 1, 1911. There has been no further treatment of any kind.

It was my intention with the other three cases to try a "therapia sterilisans magna"; accordingly each case was given an intravenous injection of 0.6 grams, followed in five days by an intramuscular injection, alkaline solution method, 0.6 grams. None of these cases ever maintained a negative Wassermann after the first month. All relapsed in four months.

Following this, I did not condemn salvarsan, but I did condemn the method; as a consequence all were reinjected and put upon mercury rubbings.

## 2. Early secondaries.

In this series there are twenty-three cases. All have had one or more injections.

Fifteen cases have continued under close observation, from five to ten months.

Three of these cases are of the original twenty-five cases reported in February. All have had two intramuscular injections after the alkaline solution method, the second injection being given at the sixth or seventh week, on top of a negative Wassermann. These three have remained clinically and biologically negative up to the present time, without any other form of treatment.

The remaining twelve have all had three injections, except two cases. Ten have had a negative Wassermann since the second injection. Here the treatment after the second injection has been the combined method, preferably rubbings.



The two remaining cases in this series are both instructive and interesting. They were treated in December. Both had lesions (early secondary). They were injected with the alkaline solution intramuscularly, both showed negative blood tests in six and seven weeks. They refused further treatment. In June both patients returned with clinical manifestations and positive Wassermann examination, each having passed from clinical symptoms with positive Wassermann to negative without symptoms and back to positive with symptoms. This shows distinctly how fruitless one injection is in moderately advanced cases.

3. Late secondaries. In this series there are thirty cases.

All have been under observation from three to ten months and have had two or more injections, except seven cases.

The older the infection the more persistent the lesions and correspondingly the more severe the treatment has been; two of the cases in this series have had four injections.

One of these cases was not able to obtain a negative result until after the fourth injection; he has had in addition one hundred and fifty rubbings in the last six months.

Another case in this series with a palmar syphilide of two years' standing with almost continued previous mercury treatment has not been able to clear his clinical symptoms with four injections of salvarsan (two intramuscular and two intravenously), together with sixty rubbings and twenty injections. The patient has been under observation for six months.

Of the remaining twenty cases that continued under my observation, three obtained a negative test after four months with two injections of salvarsan and mercury rubbings. Three obtained a negative after six months with three injections and mercury rubbings.

The remaining cases are still positive, all having had two injections combined with mercury rubbings.

The reason for this low percentage of negative reactions is attributable to the dilatory attitude of the patients in taking further treatment when all of their lesions were healed and their general nutrition was fairly good.

Under this heading I herewith report two cases of syphilis complicating pulmonary tuberculosis, where I administered the first salvarsan injection for Dr. Silvio von Ruck at the Winyah Sanitarium at Asheville, S. C.

H. Pulmonary tuberculosis. Late secondary syphilis, mu-

cous patches. Wassermann positive. April 1, 1911, intramuscular injection of 0.6 gram alkaline solution. Mucous patches healed in one week. After one month, with Wassermann still positive, intravenous injection followed by rubbings for three weeks. One month after the second treatment Wassermann negative. A third injection was given. Wassermann has remained negative. General improvement fair, retarded by digestive disturbances.

L. Pulmonary and laryngeal tuberculosis. Late secondary syphilis Wassermann positive. Intramuscular injection of salvarsan April 1, followed by Herxheimer on scalp. One month later Wassermann still positive. Salvarsan intravenously after which Wassermann became negative. There had been a marked general improvement from the first.

#### 4. Latest syphilis.

Only manifest by a positive Wassermann. This class comprises the largest number of cases, forty-four.

Here occur those infections that have been long forgotten, the so-called skeleton-in-the-closet kind.

Name.	Date of Infection.	Mercury Treatment.	No. of Salvarsan Injections.	Wassermann Test. has been
C. E. H....	6 years	Moderately severe....	2	Negative for last 5 mos.
J. C.....	5 years	Neglected .....	3	Negative for last 1 mo.
D. H. D....	10 years	Neglected .....	3	Negative for last 1 mo.
P. S.....	4 years	Severe .....	1	Negative for last 3 mos.
J. K.....	4 years	Moderately severe....	2	Negative for last 2 mos.
D. W. M....	10 years	Neglected .....	2	Negative for last 1 mo.
S. M. G....	7 years	Neglected .....	3	Negative for last 2 mos.
M. S. G....	5 years	Neglected .....	3	Negative for last 2 mos.
H. C. S....	5 years	Neglected .....	3	Negative for last 1 mo.
D. S.....	5 years	Neglected .....	3	Negative for last 1 mo.
F. L. G....	7 years	Neglected .....	3	Negative for last 1 mo.
W. E. M....	2 years	Moderately severe....	3	Negative for last 2 mos.
A. O.....	5 years	Neglected .....	3	Negative for last 2 mos.
F. F.....	10 years	Moderately severe....	3	Negative for last 4 mos.
E. H.....	14 years	Moderately severe....	3	Negative for last 5 mos.
J. D. G....	11 years	Neglected .....	3	Positive.
T. G.....	14 years	Moderately severe....	2	Negative for last 5 mos.
W. A. W....	11 years	Severe .....	1	Positive.
J. B. S....	9 years	Neglected .....	1	Positive.
A. R. C....	7 years	Neglected .....	2	Negative for last 1 mo.
L. M.....	7 years	Neglected .....	2	Positive.
M. J.....	8 years	Moderately severe....	1	Positive.
F. J.....	8 years	Moderately severe....	1	Positive.

The above table shows clearly that it is possible in a majority of cases to change a positive reaction to a negative, notwithstanding the fact that the infections have persisted a long time in a latent form. Here the possibility of getting a negative test depends upon three things:

1. Duration of the infection.
2. Amount of previous mercury treatment.
3. Willingness and ability to continue further treatment.

Twenty-three of these cases continued under observation

and treatment. It will be seen by the accompanying table that it is possible to get a negative reaction in practically all cases.

Of the remaining cases four have had two injections each, but have not been seen for five months. The rest have had one injection and have not been heard of since.

#### 5. Tertiary.

Unfortunately the cases in this class, after their lesions had healed, have not been heard of; all had positive Wassermann.

#### 6. Nerve syphilis.

In this series there are nineteen cases, comprising the following:

1. Cerebro-spinal syphilis occurring during the secondary manifestations. One case.

2. Paresis. Two cases.

3. Erb's spastic paralysis. One case.

4. Lateral sclerosis. One case.

5. Spinal syphilis. One case.

6. Tabes.

a. Incipient. Three cases.

b. Moderately advanced with marked ataxia. Three cases.

c. Far advanced. One case.

7. Syphilitic paralysis. Three cases.

8. Syphilitic atrophy. One case.

9. Optic atrophy. Two cases.

1. The first case in this series is greatly improved. He has since gone back to his work, the nature of which I do not know, as he had moved to the Pacific coast. There has been no other form of treatment administered.

2. Paresis. Both cases came under observation fairly early; one case has grown steadily worse. The other case has received a second injection and is working at present. Wassermann still positive.

4. Lateral sclerosis. This case has had two injections. Wassermann still positive. General nutrition is much improved. There has been almost a cessation of neurotic pain.

5. Spinal syphilis. There has been no recent reports; the last report showed improvement.

6. Tabes.

a. Incipient. Three cases. One case has gained a negative

Wassermann, pain has all subsided, the pupils have always reacted, never any ataxia present.

The other two cases show marked improvement in nutrition and neurotic pains and in increase in weight. All have had two injections and rubbings, treatment extending over four months. Wassermann still positive. Argyll-Robertson pupil still present.

b. Moderately advanced. Three cases. Two cases show general nutritive improvement, neurotic pains absent. Each have had two injections and Wassermann still positive. One case with one injection shows no improvement whatever; Wassermann still positive.

c. Far advanced. One case. No improvement. Wassermann always negative.

7. Syphilitic paralysis. Three cases. All are physicians. Two had two injections; all showed general nutritional improvement. Wassermann unchanged.

8. Syphilitic epilepsy. One case; no report has been received.

9. Optic atrophy. Two cases. No improvement.

10. Professional infection.

In this report are included the cases of twenty-six physicians that have been treated since last October. All had extragenital lesions except two. The reason for this I attributed to the following:

1. Carelessness in handling venereal ulcers.

2. The difficulty of differentiating these ulcers without a microscopical examination being made.

Consequently, every physician should hold every suspicious lesion in the light that it is luetic until he positively finds out that it is not specific. In this way both doctor and patient would derive benefit.

As a prophylactic measure we should not forget the application of mercury ointment where there has been an exposure to a specific infection.

#### CONCLUSIONS.

1. Salvarsan has come to be the right arm of our syphilitic armamentarium.

2. It has not produced any neuro-tropic affects in properly selected cases.

3. Combined with mercury, it acts with remarkable rapidity in curing syphilis, both clinically and biologically, and there-

fore a wonderful advance over the old method of treating this disease.

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## TUMORS OF THE HYPOPHYSIS; THEIR RELATION TO ACROMEGALY AND FRÖHLICH'S SYNDROME.

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A knowledge of the clinical symptoms of tumors of the hypophysis and the region immediately adjacent to it is of importance to the ophthalmologist, as he is so frequently consulted first by patients suffering with lesions of this gland because of interference with vision. The subject originally assigned me was the eye changes associated with tumors of the hypophysis. I asked your secretary that I might discuss the subject appearing upon your program, for it would be presumptuous upon my part to discuss the eye changes associated with hypophysial tumors before a body composed of specialists much better able to do this than I am.

Much has been added to our knowledge of ductless glands during the past ten years. The hypophysis has attracted special attention during the past five, although the impetus to this investigation was given some ten or more years ago, when an actual anatomical basis for the etiology of acromegaly was established.

In discussing tumors of the hypophysis and their relation to acromegaly and Fröhlich's syndrome, it will be necessary to review rather rapidly the histology of the gland, and what we know of the physiology of the different parts entering into its structure. A clear understanding of its histology makes simple the classification of tumors occurring within the gland. The confusion which has existed concerning this classification accounts for the slowness with which lesions of the gland have been accepted as the etiological factors in the development of acromegaly and Fröhlich's syndrome.

In 1838 Rathke described an evagination of mucous membrane of the pharyngeal cavity, which he supposed developed from the anterior end of the foregut, from which the anterior lobe of the hypophysis developed. It was demonstrated later that this evagination developed from the buccal cavity rather than from the primitive foregut, and that it was therefore of

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\*Read by invitation.

ectodermal rather than endodermal origin. This epithelial evagination soon becomes constricted off to form the hypophysial vesicle. The vesicle becomes applied to a downward projection from the floor of the third ventricle from which is developed the part of the gland now known as the pars nervosa. The epithelium applied to this downward projection from the third ventricle early becomes differentiated from the epithelium of the anterior part of the hypophysial vesicle to form the pars intermedia, the cavity of the original vesicle remaining as a cleft which separates the pars anterior from the pars intermedia.

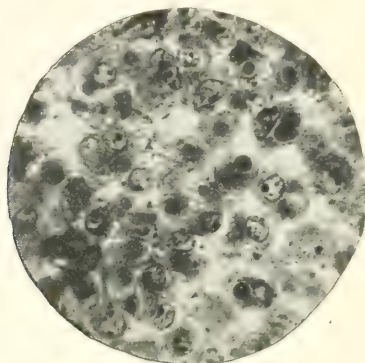


Fig. 1.

Section from the hypophysis from a case of acromegaly showing a hyperplasia of the chromophile cells.

The anterior lobe is made up, histologically, of cells with peculiar staining reactions, the protoplasm of some of them staining with eosin, some with hæmatoxylin and some taking hardly any stain at all. These different reactions to stains are supposedly due to different phases of secretion. Histological evidence seems to indicate that the eosinophilic cell represents the most active phase of secretion. The cells are arranged in the neighborhood of thin-walled venous sinuses into which they probably discharge their secretion.

The so-called pars intermedia forms an epithelial investment for the nervous downgrowth from the third ventricle. The cells of the pars intermedia have a tubular or acinaous arrangement. They contain no granules, being clear and vesicular in type. In man the cells of the pars intermedia invade the nervous tissue, extending almost up to the infundibular canal. This distribution is also found in the cat and dog. In the ox the cells of the pars intermedia form a distinct cell mantle, rather sharply demarcated

from the nervous lobe. The pars intermedia can, in this animal, be separated from the nervous tissue. The hypophysis of the ox is, therefore, the most favorable for the study of the effects of pure extracts, the physiological effects of which will be mentioned briefly later.

The cells of the pars intermedia secrete colloid which is quite comparable, so far as the histological appearance is concerned, to the colloid found in the thyroid gland. Besides this colloid there are found in the hypophyses of some animals hyaline bodies which Herring believes to be the secretion product of the cells of the pars intermedia. These hyaline bodies are supposed by Herring to pass into the pars nervosa to reach the infundibular canal to be finally discharged into the cerebro-spinal fluid from which the products of secretion are discharged into the venous sinuses by way of the Pacchionian bodies. Cushing has recently employed this theory in accounting for some of the physical changes associated with internal hydrocephalus of rather high degree, and the glycosuria occurring after operative manipulation of the stalk of the hypophysis. The pars nervosa contains no true nerve cells, being made up of ependymal and neurological tissue, which are so loosely interlaced that spaces apparently exist between them.

Another type of epithelium, the significance of which in relation to tumor formation has been but recently recognized is found in the hypophysis. Histologically, this epithelium has all of the characteristics of ordinary mouth epithelium, intercellular bridges being easily demonstrated by iron hæmatoxylin and eosin when islands of this epithelium are present. This epithelium represents inclusions of mouth epithelium. It develops from the duct which passes out to the hypophysial vesicle from the pharyngeal wall during the development of the anterior lobe. This epithelium has not differentiated to form the characteristic cells of either the anterior lobe or the pars intermedia. Islands of this undifferentiated mouth epithelium are of frequent occurrence in the gland. Erdheim found this type of epithelium in ten out of thirteen glands removed from adults. The nests of undifferentiated epithelium are situated upon the anterior surface of the infundibulum, among the cells of the pars intermedia; also on the anterior surface of the posterior lobe; and upon the surface of the anterior lobe adjacent to it. This peculiar distribution corresponds to the position of the cranio-pharyngeal duct in the final stages of development of the gland. As far

as tumor formation is concerned this undifferentiated mouth epithelium is of decided importance. Later we will discuss the relation of tumors developing from it to Fröhlich's syndrome.

Physiologically it has been demonstrated that the anterior lobe is essential to life. Animals deprived of this lobe pass into a cachectic state in which they die. Feeding experiments have given no positive results. The posterior lobe when injected into animals gives very decided effects. Animals shortly after injection can no longer coördinate their movements, they yawn and appear prostrated, the hind legs being especially affected. This

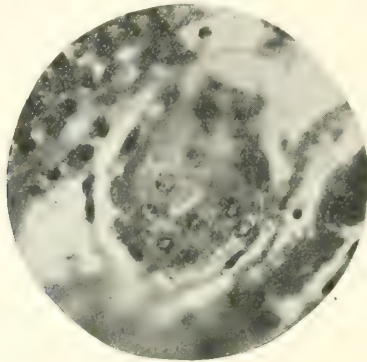


Fig. 2.

Squamous cell epithelium found upon the anterior surface of the infundibulum in a patient 30 years of age who died of peritonitis following an operation for ectopic pregnancy. Indications of intercellular bridges are shown by the dark broken borders about the cell. It is from this type of epithelium that the most common tumor about the infundibulum develops. About 33 per cent of these are associated with some or all of the features associated with Fröhlich's syndrome.

stage is followed by salivation, vomiting and purgation, the bowel movements often containing mucus and blood. Active peristalsis can be felt if the hand is placed upon the abdomen.

Intravenous injections of extracts of the posterior lobe cause a decided rise in blood pressure. The rise is not so abrupt as after adrenalin injections and does not reach such a high level. The primary rise is often followed by a fall, a secondary rise which is associated with marked slowing of the pulse, then occurring. The substance causing this rise reacts in many ways physiologically like adrenal, causing dilatation of the pupil of the frog's eye, etc. The similarities between this substance and adrenalin will be mentioned again in discussing the glycosuria so frequently associated with hypophyseal disease.

Notwithstanding that it is over twenty-five years since Marie

described the symptom-complex known as acromegaly, it is only recently that the relation between tumors of this gland and this disease has been definitely established. There are a number of reasons why it has been difficult to establish an anatomical relationship between the hypophysis and acromegaly. In the first place, there are a few undoubted cases of acromegaly in which the gland has apparently been normal. In most of these cases, however, a careful histologic examination has not been made, and it has been definitely established that a gland macroscopically normal may have undergone changes which bear a causative relation to the disease. Some six years ago I had the opportunity of examining a hypophysis obtained from an acromegalic

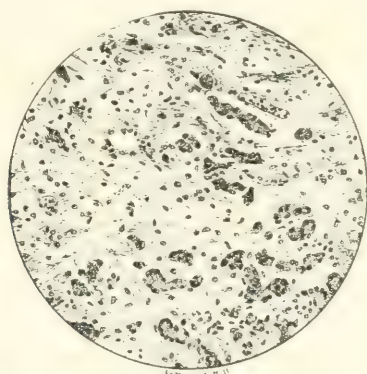


Fig. 3.

Cells of the pars intermedia of man, showing distribution between nervous elements of posterior lobe.

patient who died early in the clinical course of the disease, death being caused by cerebral embolism, and although in this instance the gland was normal as far as the macroscopical appearance was concerned, there was histologically a distinct hyperplasia of the chromophilic cells—apparently the most actively functioning cellular elements. In all cases of acromegaly in which the hypophysis is described as normal, a careful histologic examination should be made; for, as exophthalmic goiter may exist without thyroid enlargement so acromegaly may develop without gross enlargement of the gland, although this may occur at a later stage.

In the second place a great variety of pathologic conditions, such as simple hypertrophy and colloid degeneration, marked colloid degeneration and hemorrhage, sarcoma or glioma, spindle-cell sarcoma, cylindroma and adenoma with enlargement, has



been described in the hypophysis in those cases of acromegaly in which the gland has been enlarged and obviously diseased. It can be readily seen that the lack of uniformity of the lesions described in cases of acromegaly accounts for slowness with which the hypophyseal origin of the disease has been accepted. Unless a lesion is repeated with some uniformity in these cases the etiological rôle cannot be established.

The most important fact which has been established in the pathology of tumors arising from the anterior lobe of the hypophysis, is that the cells occurring in this part of the gland reproduce the morphology of a sarcoma when multiplying rapidly. The anterior lobe cell is round and in some instances large multinuclear epithelial cells are found in cases of pure hyperplasia of the hypophysis. This fact has only been recognized during the past ten or twelve years, and the recognition of this important point has shown that the lesions of the hypophysis associated with acromegaly have a decided uniformity.

Creutzfeldt in a recent article dealing with the lesions of the hypophysis gives the following statistics concerning the changes found in the hypophysis in fifty-six cases of acromegaly:

No. Cases.	Character of Lesion.	Per Cent.
5.....	Without hypophyseal changes..... or changes not mentioned.	8.9
15 .....	Sarcoma .....	26.7
12 .....	Hyperplasia .....	21.4
8 .....	Struma .....	14.2
12 .....	Adenoma .....	21.4
4 .....	No anatomic diagnosis.....	7.1

It will be seen from the above table that hyperplasia, struma or adenoma of the hypophysis was found in 57 per cent of these cases of acromegaly. It is quite probable that most of the cases regarded as sarcoma were actually adenomata of the hypophysis, the possibility of error in anatomic diagnosis being well established in these cases. It seems probable then that definite evidence of increased hypophyseal function can be found in 83 per cent of the cases of acromegaly, the common lesion being a hyperplasia of the chromophile cells of the anterior lobe which in the more advanced cases may progress to adenoma formation. The constancy of the hypophyseal changes and the frequency with which the same are repeated cannot be overlooked in determining the etiologic relationship between hyperpituitarism and

acromegaly. This relationship is emphasized by the results which have followed partial hypophysectomy in cases of acromegaly.

Two different clinical phases are often observed in cases of acromegaly, an early phase accompanied by excessive growth, and a later one accompanied by cachexia which is comparable in some ways to the cachexia observed after complete removal of the anterior lobe. In this cachectic stage, the patient often succumbs to terminal infections. This stage is often associated with fairly definite hypophysial changes, the adenoma which has developed secondary to the hyperplasia undergoing in this stage softening or necrosis leading to cyst formation.

One of the most striking features about this class of tumors is the fact that they do not form distant metastasis, although a number of them have presented evidences of very rapid growth and histologically must be regarded as malignant tumors. Even those tumors which appear the most malignant form no distant metastases, being characterized by local invasion of the adjacent structures.

#### FRÖHLICH'S SYNDROME.

Isolated observations extending over seventy years have been made of tumors situated about the infundibulum and the floor of the third ventricle which have been associated with obesity, early optic atrophy, sexual infantilism and the development of the feminine type. Although this symptom-complex was first noted with tumors situated in the position just mentioned, practically similar clinical phenomena have been observed with tumors, occurring in other parts of the cranial cavity, but these have been accompanied by a marked internal hydrocephalus.

In 1901 Fröhlich described a tumor of the infundibular region in which this peculiar symptom-complex was observed. He was the first to ascribe the development of these changes to disease of the hypophysis, and since that time the disease has been known as Fröhlich's syndrome. In any brain tumor, fat may be deposited rapidly as the result of the sedentary habits which the patients are obliged to lead as the result of loss of vision or the apathy attendant on increased intracranial pressure. In the cases of Fröhlich syndrome or dystrophia-adiposo-genitalis, these changes are so decided that we are justified in assuming that they are due to metabolic changes dependent upon secretory changes in a ductless gland.

In analyzing the cause of these changes, we must resort to pathological and experimental studies. As far as the pathological

data are concerned, the tumors most frequently associated with this syndrome form a definite group. The most characteristic features of these tumors I can best describe by quoting from a case described by Saxer. The epithelial tumor described by him replaced the infundibulum of the hypophysis, filled up and distended the recessus infundibuli and recessus opticus, and extended into the third ventricle so as to form a part of its floor, also into the lateral ventricle through the foramen of Monro. The anterior lobe of the hypophysis was normal, and the tumor was unconnected with the chorioid plexus. The nodular free surface of the tumor, especially that projecting into the third ven-



Fig. 1.

Pars intermedia of the ox. The cells forming the pars intermedia have a tubular arrangement and are sharply demarcated from the nervous tissue lying beneath. The pars intermedia can be isolated in a nearly pure state from the hypophysis of the ox. This is especially desirable in studying the effects of infections.

tricle, had a definite papillary structure. The papillæ consisted of a fairly thick, connective tissue groundwork which was covered by epithelial masses, the general arrangement of which corresponded to that of stratified, flat epithelium. The most superficial layers consisted of flattened cells which were fusiform on cross section. The deeper layers were cubical or cylindrical, and the cytoplasm of the cells was markedly vacuolated. This tumor evidently belongs to the group which I mentioned in the beginning as developing from islands of epithelium which have been pinched off from the cranio-pharyngeal duct, and lie imbedded in the infundibulum.

About a year ago I had occasion to look up tumors of this type. There were at that time reports of twenty-nine cases of

this type of tumor, and about 33 per cent of them presented some or all of the symptoms associated with Fröhlich's syndrome. Since that time a number of other cases have been reported and the majority of these have been associated with adiposity and sexual infantilism.

The cause of these trophic disturbances has been variously interpreted. Erdheim believes that adiposity with genital atrophy, and in the male, with the development of the feminine type, is not due to any interference with the function of the hypophysis, but, that it is the result of pressure exerted on certain centers at the base of the brain by the enlarging tumor. He has noticed that this syndrome has been most frequently associated with those tumors which grow out of the sella, and extend to the base of the brain, and with those in which the tumor has not developed in the sella or the hypophysis proper, but from the infundibulum. In support of this theory of pressure at the base may be cited cases reported by Selke, Boyce and Beadles, Babinski, Cestan and Halberstadt and Gläser. It is an interesting fact that in all of these cases the tumor was so situated that it could easily interfere with the function and viability of the pars intermedia, even if the anterior lobe of the hypophysis were intact.

Tumors other than those occurring about the infundibulum may be associated with this syndrome. Tumors in the posterior fossa causing internal hydrocephalus may be accompanied by adiposity and sexual changes, but in these cases the floor of the third ventricle is usually forced downward like a funnel upon the posterior lobe of the hypophysis. Whether these disturbances are due to the failure of the hyaline bodies to reach the cerebro-spinal fluid by which they are supposed to be finally absorbed, and from which the secretion is supposed to be discharged into the venous sinuses or to direct pressure upon the posterior lobe is still, I believe, open to discussion.

Fröhlich's syndrome has also been noted with a lipoma at the base of the third ventricle, with an ependymal glioma of the third and fourth ventricles and with serous meningitis.

Some of the symptoms associated with Fröhlich's syndrome may occur in acromegaly. It has been stated that adiposity occurs in about 1.6 per cent of the cases of acromegaly and that genital changes occur in over 32 per cent. This percentage is probably somewhat too low. It is certain, however, that sexual disturbances are much more common in acromegaly than adi-

posity. The theory advanced some time ago by Cushing and others to explain the adiposity and sexual infantilism was hypopituitarism. It is difficult to explain satisfactorily the combined picture upon this basis, for it is difficult to conceive how a gland may be overactive and underactive at the same time. We have in the hypophysis two distinct types of epithelium, and in case of enlargement of the anterior lobe, such as is common in acromegaly, the posterior lobe could be pressed upon and its function impaired by a growth situated anterior to it.

There is an intimate relation apparently between lesions of the hypophysis and the genitalia-amenorrhea in women, and impotence in men—often being the first indication in hypophysial disease. In some cases, amenorrhea has preceded by fifteen years other symptoms associated with hypophysial disease. In the cases of adiposity with sexual infantilism, one would immediately think of the possibility of the adiposity developing after sexual atrophy, the hypophysial lesion being primary, the sexual changes following this and the adiposity being dependent upon the loss of testicular or ovarian secretion.

The sexual changes are, however, not always present in these cases. Bildl found that only twelve out of thirty-two cases of hypophysial adiposity presented genital changes, and that even in some of these cases the genital changes did not develop early.

That an intimate relation exists between the ovary and testicle and the hypophysis seems to be borne out by experimental work, for examination of the hypophyses after castration has shown, according to some, definite histological changes. Changes in the hypophysis during pregnancy are marked, the hypophysis having enlarged in some cases enough to cause disturbances in vision that have subsided after delivery.

Amenorrhea or impotence becomes an important symptom when associated with evidences of intra-cranial lesions as they are then suggestive of deranged hypophysial function.

Glycosuria is observed relatively frequently in acromegaly. Hanseemann in 1897 collected reports of ninety-seven cases of acromegaly. Seventeen of these cases had a glycosuria and Hanseemann expressed the opinion the percentage would have been much larger if the cases had been more closely observed. Hinsdale in 1898 found that glycosuria had been noted in fourteen of 130 cases of acromegaly collected by him and subsequently Lannois and Roy recorded sixteen cases with glycosuria;



the postmortem examination in these instances having shown a pituitary enlargement.

Borchardt was one of the first to attempt to produce a glycosuria by injecting hypophysial extracts. He used extracts of the entire gland. In studying 176 cases of acromegaly he found that spontaneous glycosuria had occurred in sixty-three and that in eight others there was a lowered assimilation limit. Seventy-one of these cases had a deficient carbohydrate metabolism. Borchardt was able to show that extracts of the hypophysis caused, especially in rabbits, a hyperglycomia and glycosuria, the reducing body being glucose. Appreciating that his experimental data were insufficient, Borchardt interpreted his results as at least indicating that the glycosuria occurring in acromegaly was dependent upon overactivity of the hypophysis.

Because of the similarity in reaction between adrenalin and posterior lobe extracts, Miller and Lewis thought that the gly-

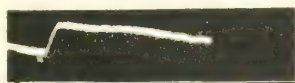


Fig. 5.

Effect upon blood pressure of the intravenous injection of 0.018 gm. of dried pars intermedia with depressor substance removed.

cosuria associated with hypophysial lesions might be due to the action of the posterior lobe. Adrenalin subcutaneously, intravenously and intraperitoneally causes a glycosuria; the intraperitoneal injections giving the highest percentage of sugar. We have injected thirty animals with extracts of different parts of the hypophysis and in but three of these have we obtained a glycosuria. In two instances glycosuria followed injections of extracts of the anterior lobe, and in one instance injection of the posterior lobe. We can draw no conclusions from these data other than in each of the three instances in which glycosuria was observed extracts of the pars intermedia were injected. Goetsch, Cushing and Jacobson have recently published some important and interesting observations in which they attribute glycosuria occurring in hypophysial disease to increased absorption of posterior lobe secretion.

One of the interesting features about Fröhlich's syndrome is the frequency with which polyuria is observed some time during the course of the disease. Extracts of the posterior lobe have

a marked diuretic effect and the diuresis occurring in Fröhlich's syndrome is undoubtedly due to increased secretion and absorption of the products of the pars intermedia. Some of the cases have presented evidences of a true diabetes insipidus.

Dr. A. B. Kanavel of Chicago recently operated upon a patient presenting Fröhlich's syndrome. During this operation the contents of a cyst about the infundibulum were evacuated. Following the operation the patient passed as many as 6000 cc. of urine a day. The amount gradually reduced until the normal was reached. The idea naturally suggests itself in these cases that the glycosuria which occurs in the adult may be the direct result of the diuretic action of extracts of the posterior lobe of the gland, young people with a high sugar tolerance presenting the clinical picture of diabetes insipidus, adults with a low tolerance, diabetes mellitus. Diabetes insipidus may be due to overactivity of the pars intermedia. This etiology is more satisfactory than any that has yet been suggested for the condition.

122 S. Michigan Blvd.

## CATARACT EXTRACTION WITH CORNEAL SUTURE.

E. C. ELLETT, M.D.

MEMPHIS TENN.

Probably every person who ever operated for cataract has felt the desirability of having some satisfactory mechanical means of closing the wound after the operation is completed, just as we have and use in other parts of the body. As far as I know, no such means except a suture has ever been suggested. Certainly at present we have an unobjectionable substance that could be applied to the surface of the eye ball to accomplish the coaptation and protection of the wound. Sutures are used in muscle operations, operations on the conjunctiva and on wounds of the sclerotic, but only rarely is an effort made to place a suture in the corneal tissue. With the popularity of the conjunctival flap in the incision for cataract extraction, the possibility of using a suture becomes apparent, but, as advocated by some surgeons, it is not much of an advantage, as it would not be placed till the operation was completed, and if the operation has been safely completed and a good conjunctival flap secured, one is willing to let matters rest and not carry out further manipulations with their possible risks. A suture at the apex of the conjunctival flap is not much help, as it exerts little influence on the corneal or corneo-scleral wound. The flap, as we have all seen, smoothens out and applies itself neatly, quickly and firmly in place without any suture.

A very good review of the subject of the suture in cataract extraction was published by Bates in the Archives of Ophthalmology, Vol. XXVII, p. 181, since which no similar summary of the work has been given. To this article, I have referred for some account of the early efforts with this method. From animal experiments, Bates thought that the suture should pass through the cornea (Fig. 1), as a suture passed merely into it produced, when tied, an inversion of the edges of the wound that was not desirable, especially as it invited adhesion of the iris to the wound.

Realizing the possible good to be accomplished by closing the wound by suture after the extraction of a cataract, H. W.

Williams of Boston, first advocated its use, and described and practiced it as follows:<sup>1</sup>

"The advantages of the corneal flap extraction may be much enhanced, and its dangers materially lessened, in my judgment, by use of a suture to retain in apposition the edges of the wound. Securing a more immediate union, we not only avoid ulceration of the border of the flap, and prolapsus iridi with its attend-



Fig. 1. A suture including all the layers of the cornea. (After Bates.)

ant evils, but the prompt restoration of the fullness of the globe, and of the normal relation of its several parts, lessens the chances of irritation from pressure of any cortical fragments or remnants of capsule upon the delicate contiguous structures, and the occurrence of irido-cyclitis. This suture, a single strand only of the finest glover's silk, passed through the edges of the wound by means of a very minute, short needle, held by forceps can be tolerated, without detriment, even in



Fig. 2. The suture of H. W. Williams (Bates).

the cornea; but at present I am disposed to extend the corneal flap at its apex a little way into the conjunctiva, so as to allow of the placing of the suture in this membrane, where it is more easily inserted than through the tougher corneal tissue."

Suarezde Mendoza published<sup>2</sup> in 1889 and 1891 a series of thirty-eight cases in which a corneal suture was used. He made a shallow incision on the outer corneal surface and passed a fine suture through the edges of this incision (Fig. 3). The loop of the suture was left long and laid to one side. The incision was then made in the usual manner, passing into the groove and between the two threads. Suture of the conjunctiva (Fig.

<sup>1</sup>Annals of Oph. and Otology, Vol. I, p. 102.

<sup>2</sup>Recueil d'Ophthal., 1899, pp. 47, 523 and 544. Ibid, 1891, p. 599.

3) has been tried by C. H. Williams<sup>3</sup> (Fig. 4) and a few others, but on the whole the method of suture of any sort has never become popular. In 1894 Professor Kalt of Paris published<sup>4</sup> a new method of suture, and reported fifty cases in which he



Fig. 3. The suture of Suarez de Mendoza. (Bates.)

had used it. His method more nearly resembles that of Mendoza (Fig. 4), but no preliminary incision is made. It is described as follows:

"I use very fine, short, sharp-pointed needles, and thin but



Fig. 4. The suture of C. H. Williams. (Bates.)

strong silk threads. The needles, when armed, are sterilized in hot air and kept for use in a sterilized paper envelope. After cocainizing and disinfection, I pass the needles through the cornea, in the vertical meridian, about 1 mm. underneath the

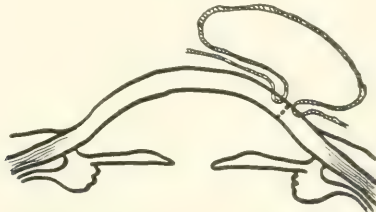


Fig. 5. The suture of Kalt. (Bates.)

limbus; the point, without penetrating into the anterior chamber, emerges at the juncture of the opaque border, and the

<sup>3</sup>Boston Medical and Surgical Journal, April 16, 1896.

<sup>4</sup>Archives of Ophthal., XXIII, 1894, p. 421.



thread is drawn. Then the needle is introduced, about 1 mm. above its point of exit, into the episcleral tissue, as is done in the muscular advancement. So soon as I find that the point has penetrated into the resistant tissue I draw it out again, in order to involve as little of the tissue as possible. As it is impossible to draw the needle out at right angles about 2 mm. of conjunctiva are loaded on it, which is of no consequence. In drawing this thread I leave a loop, which is placed sideways toward the nose, and spread out carefully so as to avoid twisting (Fig. 6).

The corneal section is made in the ordinary way, care being taken that the knife passes nicely through that portion of cornea

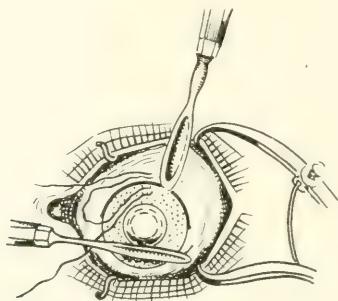


Fig. 6. The suture of Kalt. The upper stitch is now passed parallel to the corneo-scleral junction. (Wood.)

which the suture has left free. Then I take off the speculum, and remove the cataract as usual. When the iris is well in position, an assistant holds the upper lid up, and I tie the thread.

It is to be borne in mind that I do not, like Suarez, make a superficial incision into the limbus cornea, in the depth of which lie the points of entrance and exit of the thread, for this makes the corneal section with the narrow knife very difficult without cutting the thread in so narrow a passage. The coaptation in my procedure seems to me sufficient. Furthermore, I am not afraid to draw the knot tightly at the risk of folding the cornea. This folding disappears in a day, and the corneal astigmatism is neither increased nor diminished."

A second paper by Kalt<sup>5</sup> reports 2000 cases operated on by this method, and also describes his modified technique. Certainly this is the most extensive trial of the corneal suture, and somewhat extended quotations from the last paper will

<sup>5</sup>*Annales d'Oculistique*, June, 1910.

make clear Professor Kalt's views on the subject. He calls attention to the fact that prolapse of iris occurs after simple extraction in the hands of excellent operators in the proportion of 10 or 12 per cent, and that excision of this prolapse presents great practical difficulties as well as danger of loss of vitreous. Iridectomy as a step of the operation does not exclude entanglement of the pillars in the extremities of the corneal wound. If we could prevent hernia of the iris he thinks we would all prefer to do simple extraction, and to that I suppose we would all here agree.

The instruments used by Professor Kalt are de Wecker's needle holder, without catch, and a special needle, of extreme firmness and perfectly pointed. The needle penetrates about one-half the thickness of the cornea and then emerges. Immediately after being used the needle is cleaned and oiled. The thread is cotton, and composed of two or three strands. The needle is threaded, and needles and thread are put in a paper envelope and sterilized by dry heat. A special scissors is used for the removal of the stitch, but the ordinary iris scissors will answer.

"Placing the suture.

"The suture consists of a vertical corneal portion and a transverse episcleral portion. The whole forms a T, with a gap between the junction of the horizontal portion with the vertical portion. The length of each of these portions does not exceed 1 mm. The vertical intracorneal branch follows the vertical corneal meridian and stops exactly at the juncture of the transparent portion with the sclera. The horizontal portion traverses the opaque part of the limbus as near the cornea as possible. An interval of 5 mm. corresponding to the limbus is ample to permit the passage of the knife."

Not to quote verbatim the rest of the paper, it is stated that in passing the suture the corneal portion (vertical) is passed first. The loop of the suture is left long and is laid to one side, and if wet will adhere to the skin, or to the gauze with which it is covered, and not get tangled. In passing the knife, the incision may be completed in an oblique meridian of the cornea instead of the vertical, thus rendering the cutting of the thread less likely. The corneal incision, capsulotomy, and delivery of the lens being completed, the thread is drawn by pulling on its upper (scleral) branch, and a square knot is tied. If this suture is well placed, and the points are close to each

other, tying them does not cause much folding of the cornea, but it is of no matter if it does, as the post-operative astigmatism is not affected thereby. Prolapse of iris and vitreous, if they occur, are reduced by tying the suture and thus approximating the corneal wound. "The knot once tied, one is master of the situation." Cortical masses are removed with a suction aspirator, and the iris smoothed into place without fear of provoking loss of vitreous. Eserine may be used when the iris tends to prolapse, but is not as a rule. The dressing is monocular, and patients get up on the second day. The stitch is removed on the second or third day, usually the latter.

The only accident attributable to the stitch is infection of the stitch hole in the cornea. This is rare, and if the stitch is at once removed it remains limited.

Prolapse of the iris occurred in 6 per cent of Professor Kalt's earlier cases, but with improved armamentarium he has had but 3 per cent of prolapse in his last 1100 cases. The hernia which occurs with the suture is very different from that which may occur without suture. The latter is often large and its excision is difficult and attended with danger of loss of vitreous. With the suture the hernia is limited to one side of the stitch. Its excision is easy and there is no danger of prolapse of vitreous.

According to Professor Kalt, the suture is indicated in all cases of cataract, senile or otherwise, not complicated with adhesions of the iris to the lens capsule. It is especially indicated in young subjects.

The objections urged to the operation are the difficulty in passing the stitch and the danger of cutting it with the knife. This is perhaps true, but it can be placed and the section made without cutting the thread. Kalt cuts it in 1 per cent of his cases, and with a little skill it can be placed again in the same tracts.

Allport mentions<sup>6</sup> seeing a corneal suture used by Dr. Webster of New York in a case in which he especially feared loss of vitreous. A double needled thread was used and the stitches were passed parallel to the corneo-scleral junction and *tied loosely*. This is not in accord with Kalt's practice, since he passes the suture a little differently and *ties it firmly*.

In the summer of 1910 I had the opportunity to visit Professor Kalt's clinic at the Quinz-Vingt Hospital and saw him operate with the corneal stitch. I also saw one of his results, and on

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<sup>6</sup>Oph. Record, March, 1911.

my return I made use of this method as occasion presented. In all I have used it nineteen times, all in cases of senile cataract, except in one case of dislocated lens. The results were in the main satisfactory. In two cantankerous old men who would not keep still, a small prolapse of the iris was found at the first dressing, within twenty-four hours after the operation, and was excised without difficulty. The prolapse, as Professor Kalt points out, was small and limited to one side of the wound. The excision was easily done, the pillars of the coloboma were easily dressed back and the ultimate result was excellent, with a narrow oblique coloboma. One additional prolapse occurred in a perfectly tractable and quiet patient without apparent cause. This was also excised without any trouble and the final result was excellent. By the "result" is meant the surgical result. The visual result is no better than in a successful cataract extraction by any other method.

In contrast to the three cases of prolapse, I had one patient, a woman with chronic nephritis, who had on the night of the operation two quite severe uremic convulsions. I was in the hospital when these occurred, and under appropriate treatment the convulsions subsided, but she was unconscious for several hours. When I visited her the next morning my nurse had prepared, without any suggestion from me, the instruments and solutions for excising a prolapse of the iris, which she thought would certainly follow the convulsions. To our surprise the wound was perfectly closed and the iris in place. No subsequent accident occurred and the final result was perfect. In another case the patient sneezed, causing a gaping of the wound. The speculum was removed, when a spasmodic closure of the lids turned the upper half of the cornea down on itself. The lid was quickly raised, the suture tied and, as Kalt says, I was at once master of the situation. The ultimate result was perfect.

The suture is surprisingly easy to insert. A farm hand could not place it, but to any one possessing the necessary skill for ophthalmic surgery, there is no difficulty.

In tying the suture I make a double turn, securing the knot against slipping. By drawing it tight enough to produce slight wrinkling of the cornea one is assured of approximation of the wound edges, and there is no objection to this, as one case was found to be untied at the first dressing, just as we sometimes see happen in the case of conjunctival sutures, as after a ptery-

gium operation. In this instance the suture had served its purpose, however, and the wound had closed.

Some authors (Wood, *System of Ophthalmic Operations*, Vol. II, page 1221; and Black, *Oph. Record*, Vol. XIV, page 75) object to the stitch in that it requires practically a second operation for its removal. This does not seem to be a practical objection. The patient need not be told that there is a stitch in the eye, and when the time comes for its removal the eye is cocainized and he is then told that there is a thread to come out which will take a moment. The lid is raised, the suture seized, cut and drawn out without any disturbance.

In none of my small series of cases did the stitch cause any irritation. In none of this series did the slightest affection occur.

I was fortunate enough not to cut the stitch in making the corneal incision in any case. In one case, that of dislocated lens, there was considerable loss of vitreous following the incision, and in removing the speculum hastily the thread was caught and its corneal portion torn out. I was thus deprived of its help in a case in which it would have been of signal benefit.

Some one, I do not recall who, has suggested the use of an absorbable suture (catgut) which need not be removed. This is theoretical, as the finest catgut which I have ever been able to procure is much too coarse to use for this purpose, and would not pass through the eye of the needle.

The scar left by the stitch is a minute vertical one which is hardly perceptible. At least, it constitutes no objection to the operation.

I do not pretend from this small series of cases to advocate the stitch as a routine step in cataract extraction. To my mind it is a very valuable addition, whose advantages far outweigh its disadvantages, and I expect to continue its use. I present my personal experience for what it is worth.

Exchange Building.

#### DISCUSSION.

DR. S. D. RISLEY:—In 1891 or 1893 I was in Paris and went with the late Dr. Herman Knapp to Kalt's clinic. We saw him do six cataract extractions in rapid succession, in each of which he employed his corneal suture. He was then using the method to which Dr. Ellett has called our attention. He was inserting the stitch in the cornea and vertically in the sclera. He then made his section of the limbus of the cornea between the upper and lower segments of the stitch and drew them tighter than we thought necessary. When I came home I did the operation and have continued doing it in every case in which I had doubt as



to the obedience of my patient or feared a probable loss of vitreous from any cause. I also have been fortunate in not cutting the stitch in any case and think there is very little danger of doing so if the suture is properly inserted. Its advantages are all that Dr. Kalt claimed for it. It did not increase the astigmatism or diminish it, but I have always drawn the stitch less tightly than I saw Kalt do. In those cases where there is a probability of losing vitreous I think the Kalt suture is a great safeguard. In a considerable number of cases where I have correctly anticipated this accident and employed the suture I have seen a large bead of vitreous present as soon as the corneal section was made, and by simply taking hold of the loop and two ends of the stitch and pulling them up gently, I was delighted to see the vitreous sink back almost at once; and after the lens has been delivered, should a bead of vitreous be present, the same procedure has invariably caused its immediate restoration. The ease with which it can be inserted is noteworthy. A suitable needle, a proper pair of needle forceps and suitable thread are essential. The resulting corneal scar is inconsiderable; indeed, in many instances it is so faint that it must be sought for with oblique light.

DR. J. M. RAY, Louisville, Ky.:—In the summer of 1900 I was in Paris with Dr. Webster and we watched Kalt do a number of operations. I came home, tried it a few times with success; especially does it appeal to me in cases of tremulous iris or shaky lens where loss of vitreous is feared.

The trouble I had was in obtaining the proper needles. It takes a short, heavy needle without any spring in it.

DR. F. S. STUEBER, Lima, O.:—The paper is of interest. I understand the essayist to say that the suture may be applied as a routine practice. Personally I cannot approve of this as a routine. As in other parts of the body if a wound is gaping—edges not in apposition—then sutures are indicated, however the fewer the better. Writer states that a conjunctival flap, if we are fortunate enough to obtain one, is a most suitable place for suture. No doubt in conjunctiva, sutures will cause less irritation than when placed through corneal tissue proper, however in my opinion, here it is least indicated, since the conjunctival flap becomes adherent in a few hours. In an ideal extraction the less the eye is manipulated the better.

DR. W. REBER, Philadelphia:—Dr. Stueber's last remark as to the "Ideal Extraction" brings me to my feet. If any gentleman in this room will tell beforehand when he is going to do an ideal extraction I will bow low and take off my hat. Those cases we think are going to be ideal, behave desperately. We approach others with fear and trembling, and the patient might as well be a piece of wood the way they allow us to cut them. The ideal extraction is only to be pronounced the ideal extraction *when you have gone home!*

I have used the corneal stitch five times. The first time before I had seen Professor Kalt's work at all, and because Professor Hansell put a case up to me. We had been talking about extraction of the lens in its capsule, and he said, "Here is a case, take out the lens in its capsule." I extracted the lens in its capsule. Then that eye decided to spill vitreous all over the operating room and I was much discouraged. The eye was hurriedly closed and bandaged. Forty-eight hours later I used on him my first corneal suture. This man finally secured vision

of 3/10. Later I went to Europe and saw Kalt doing sutures. I came home and did four, having prolapsus in one. I have tremendous respect for Dr. Risley's opinion, but I cannot agree with him entirely about the suture. The objection as to infection I consider slight. The objection as to the cosmetic result is probably nothing. The objection about taking out the stitch afterwards is valid, for the patient is ready to believe something has gone wrong. Cataract cases are the most psychically alert cases we have. If you do as Dr. Ellett has urged—that is, not let them know the stitch has been used and go about it quietly on the third day, it will probably work out all right, but it is not an easy matter to cocaineize an eye on the third day of its post-operative reaction. Those who have tried to reduce or excise a prolapsus know that. On the other hand, I know nothing that allows a man to go home with so quiet a feeling in his breast as will a corneal suture if there has been threatened prolapsus, for one may feel sure. Unfortunately, as I have said, we cannot determine beforehand just which cases we ought to suture. The thing I now do is to apply my little glass cornea which I have devised to fit over the cornea, and look through it. It is like a watch crystal. I am making a further improvement; a gold rim about 2 mm. in width and 9 mm. in diameter, which covers the corneal brim; it permits one to control the corneal flap absolutely; moreover, one can slip it down and put in a corneal suture. The classic procedure in prolapse of the vitreous is to snip off what one can. Oftener one is called upon to do the best they can and this they do by immediately binding up the eye and turning the patient over to the Lord! That is what the majority of surgeons do, as I have observed them. If we have some means of keeping the cornea in position, controlling it and then proceeding with intelligent rational surgery, as indicated by the essayist, by all means let it become popular. I think the sensible, rational way is to prevent the most formidable of all things with us, the loss of vitreous and this I believe can be done by the use of a corneal controller such as I have suggested. Then, if necessary the corneal suture may be resorted to and only in such cases as are plainly indicated.

DR. J. L. THOMPSON, Indianapolis:—I have never used sutures in my cataract operations, nor have I seen them used by others. In the book of Dr. Williams of Boston on "Eye Diseases," published nearly fifty years ago, he advocated corneal sutures in cataract extraction; but the practice met with disapproval in nearly every country.

I can recall several cases of large rolls of prolapsed iris, from four to seven days after some of my ideal extractions without iridectomy, cases in which the pupils were beautiful, round and central; had sutures been used in these, doubtless the prolapsus would not have happened; but still, I was never tempted to resort to their use.

Now eye, ear, nose and throat specialists are so numerous and their cataract extractions are so few that the very great majority will not attempt this hazardous and complicated method.

DR. E. C. ELLETT (closing discussion):—It is very gratifying to hear that those of larger experience have come to the same conclusion that I have from my few cases. At the *Quinze-Vingt* Hospital there are four surgeons, three of whom employ this method; namely, Kalt, Valude and Chevallereau. The point argued in its favor is safety attending the toilet of the wound, the removal of cortical, etc.

The needles which I have were obtained in Paris, presumably made at Kalt's direction.

I was misunderstood by one of the speakers in regard to the suture in the conjunctival flap. I said that I presumed most of us would feel if we had completed the operation and knew we had done an ideal operation and everything was in shape, the less manipulation we could get away with the better off we were.

I have not had the trouble with removing the stitch that some have referred to. Just think of it this way; that this may be your five hundredth cataract extraction, but it is the patient's first, and he does not know but that everybody has to have his eye sewed up. He need not be told that there is a stitch to come out until the eye is cocainized and everything ready for its removal. We all know that a good many people seem to dread the removal of stitches more than they do the operation itself, but in this particular case I think the stitch can be removed before the patient realizes that there is anything more to be done.

## OPERATIONS FOR CATARACT UPON THE EYES OF THE VERY AGED.

GEORGE F. KEIPER, M.A., M.D.

LA FAYETTE, IND.

What shall be our method of procedure in operating for cataract upon the very aged, is the question that we shall attempt to answer both by this paper and the discussion that follows, for in the multiplicity of counsel there is wisdom in things medical as well as in things in general.

By the term "very aged" we mean to refer to those who have reached the age of ninety years and over. Such persons are very uncommon, especially so those who have reached the century mark. The tables of actuaries show that out of 100,000 persons 13,290 reach the age of eighty years, 5,417 reach the age of eighty-five years, 1,319 reach the age of ninety years, 89 reach the age of ninety-five years, while only one person reaches the age of one hundred years. So that persons of ninety years of age and upward are indeed very rare. Patients of those ages are still rarer because but a minority have cataract.

It has fallen to the lot of the writer to have operated on a man of ninety-three years of age and a lady of one hundred and one years of age. Both were operated upon for cataract. In the former case we not only lost the eye through panophthalmitis, but also the patient, as will be detailed later. In the latter we secured a most beautiful result. The first case was operated upon eight years before the latter case. Unusual precautions were taken to avoid in the latter case the baneful results obtained in the first case.

By one who lives in the past, and who so far as this life is concerned, realizes that but a very short time yet remains, any operation, though needed, is liable to be considered very seriously, especially so in the past when aseptic surgery had not attained the perfection attained in this present day.

Very aged persons are to be handled with very great care surgically and otherwise. Under undue excitement very aged persons have expired promptly. When thus handled so far as cataract is concerned, many have responded to operative inter-

ference with surprising good results. Yet age is a relative term, for some seem young at ninety and some old at forty.

Before operating upon the very aged for cataract, I would urge the following, in addition to our usual preparations:

(1) A very careful eye examination. The kind of a cataract must be determined. The light sense and fields of vision should be carefully ascertained; the latter by two candles, one stationary, for fixing the eye and the other moving to determine the outlines of the fields of vision. Ascertain the condition of the conjunctival sac and see to it that it is as sterile as possible. No operation should be undertaken unless the prospects are most excellent, for the recovery of vision. To fail because there was never any prospect for vision is harrowing to any patient, but most of all to the very aged, hoping for but a few days of vision and wishing for the last time to be able to see those near and dear before departing this life, or as in the case of the latter patient, to be able to see enough to be able to attend the dances periodically given in the home of which she was a member.

(2) A most thorough physical examination is demanded. At the same time the mental condition must be ascertained. This should require plenty of time and in an institution. Two weeks is none too long. After all our eyes are but organs in a body and depend for their weal or woe upon the condition of the body in general. A thorough chemical examination of the urine should be made. This should be repeated at intervals. The blood should be examined as to its coagulability and content, as to the percentage of hæmaglobin and the relationship between the white and red cells, and the number of the latter. The use of the sphygmomanometer is especially urged to ascertain the blood pressure. If the pressure is high the use of sodium nitrite is urged. The bowels should be thoroughly cleaned out and rendered as sterile as possible just prior to the operation. In fact, all emunctories should be in good working condition.

It is very important to ascertain the mental condition of the patient especially when off guard. The patient ought to be able to rest well at night.

If our patient be a man with an enlarged prostate gland, the bladder should be sterilized as much as possible by the exhibition of some one of the numerous formaldehyde preparations. It has been proven that formaldehyde is secreted by other mucous membranes besides those of the bladder, especially those of the



ear. Why not the eye membranes? This has been demonstrated lately by Gradle.

If all is favorable up to this point, then:

(3) A preliminary iridectomy is indicated. It seems to be most reasonable here. The preliminary iridectomy gives us a good opportunity to find out the behavior of the patient as to the healing of the wound and his or her mental disposition under restraint.

When the iridectomy wound has healed and the eye has resumed its normal appearance and condition, the extraction of the cataract may be attempted. The latter will be much easier upon both patient and physician because a prolonged operation is avoided.

(4) After either operation, the patient must be kept upright as much as possible and quiet, but cheerful and hopeful. Hypostatic congestion of the lungs is no myth in these very aged people and is to be much feared and guarded against. Above all keep the mind of the patient free from the feeling of restraint.

(5) It seems reasonable that the eye not operated upon should not be bandaged. It will likely be possessed of poor vision and the patient is not likely to use it, especially if docile and well instructed not to attempt to use it at all.

(6) If aseptic surgery means anything in operative work it certainly means more here than elsewhere. The resistance of these patients is below par as a rule, and to permit even a single destructive germ to lodge or remain in the conjunctival sac is to invite disaster.

The failure to observe at least all what is outlined above, I believe was partially responsible for the lamentable failure encountered in the first case, and the observance of all outlined above contributed in no small measure to the brilliant success attained in the second case.

The histories of the two cases referred to are as follows:

Case 1. Charles Reute, aged 93, a member of the Indiana State Soldiers' Home, visited my clinic at the Home the latter part of April, 1901. He was blind in both eyes from cataract. Examination seemed to show that the right eye was the better one on which to operate. The cataract of the right eye was accordingly promptly removed by a very smooth operation, but

without preliminary iridectomy. In three days violent panophthalmitis developed. This we attempted to cut short by a prompt enucleation. He did fairly well until three days afterward, when a fire broke out in the hospital wherein he was confined. He was the last one to be taken out through the dense smoke that filled the building. Before he was reached he was so terrified that he tore off his bandages and sought escape. When found he was well nigh suffocated. When removed to new quarters



Mrs. Eliza Sharp, with her nurse and Dr. King, surgeon-in-chief Indiana State Soldiers' Home. (After adjustment of her glasses.)

he promptly took to his bed and despite all treatment he gradually sank and died. How much of this result was due to the panophthalmitis and the subsequent enucleation and how much due to the fright that he endured, is hard to say. A post-mortem examination was not obtainable.

Case 2. Mrs. Eliza Sharp, a member of the Indiana State Soldiers' Home, consulted me about July 1, 1909, as to her eyes. She was then in her 101st year, a white woman and of remarkable intelligence and vitally, physically and mentally.

As outlined above we took unusual precautions with her and

extended our examinations over a period of two weeks. Every detail as to her general health and mental condition was gone into. After satisfying ourselves that she was a fit subject for a cataract operation, on July 29, 1909, we made a preliminary iridectomy on the left eye. This healed promptly without hardly any reaction. On August 23 we extracted the cataract. The healing was just as prompt as in the operation for the iridectomy. No opacity of the capsule was detectable. The resultant vision was 20/L with a plus 10.00 lens. With a plus 14.00 D. lens she was able to read No. 3 Jaeger. And thus was her desire fulfilled in that she was able again to attend the dances given at the Home for the benefit of its members. Though she lived but six months afterward she was a very happy woman all this while and enjoyed her last days to the fullest extent possible. When she reached the age of 101 a large celebration in her honor was planned and carried out. This taxed her strength so much that she broke under the strain and in one week died, worn out from too much excitement. Photographs of her taken after the operations accompany this article.

After having this unique experience, I addressed letters to about three hundred oculists in different parts of this country to ascertain what might be their experiences along this line. The reports from those who did me courtesy of reply reveal that but very few people over 100 years of age have ever been operated upon for cataract. In fact the appended table shows but seven cases reported.

To this paper is appended a table which shows all cases of ninety years and over that have been reported to me, as the result of this correspondence. Interesting facts are shown therein. Of the seven cases over 100 years of age, all are women. What may be the meaning of this will be a matter of interesting speculation.

Another fact revealed is that wounds in these very aged people seem to heal even better than in persons of younger years.

The great lesson to be drawn from this investigation is this: If the very aged person is in good health physically and mentally a cataract operation should not be denied that person if all is favorable for a successful result. If the operation is successful that patient will receive the greatest boon that can be conferred.

TABLE OF CATARACT OPERATIONS UPON PATIENTS  
90 YEARS AND OVER.

Operator	Age of Patient	Sex	Remarks.
Heimitsch, Spar-tansburg, Pa....	103?	Female	Working in the fields at last report. Reported by Webster Fox (P. C.).
Webster, New York.....	105?	Female	Colored. Iridectomy. Could read. Had enuclea-tion of other eye simultaneously.
King, Alliance, O.....	102	Female	Good result. Conjunctival flap.
Strader, Cheyenne .....	101?	Female	Colored, preliminary iridectomy. Extraction four weeks later. Fell on getting out of bed on the fourth day. A. C. filled with blood. Eyeball softened.
Keiper, LaFayette .....	101	Female	Preliminary iridectomy. Cataract extracted four weeks later. Ideal result.
Lamb, Washington, D.C.	100	Female	Able to see and is 117 at last report. From Dr. Belt's practice.
Beard, Chicago.....	100	Female	Colored. Both cataracts removed. Results ideal.
Smith, E. Detroit.....	99	.....	Usual success. Usual rapid recovery. Usual preparations only.
Cheatham, Louisville.....	99	.....	Needled capsule at 100. Lived to be 100. Vision ultimately failed.
Baker, Cleveland.....	97	Female	Lived to be 103. Mentally bright. Bent with arthritis deformans.
Rogers, Providence.....	97	Male	Indian. Good result. V. 20/40. Lived to be 100.
Leech, Providence.....	97	Male	Indian. Good results. V. 20/40. Lived to be 100. Probably preceding case.
Lamb, Washington, D.C.	96	.....	Satisfactory result.
Williams, H. W. Boston.....	95, 90	.....	Four cases. Successful. Reported by James Moores Ball, p.c.
Wood, Casey, Chicago.....	94	Male	Preliminary iridectomy. Acute mania. Died two years later.
Carrow, Detroit.....	94	Male	Lived to be 100 and kept the vision attained.
Calhoun, Atlanta.....	94	Male	Nothing of importance in healing.
Keiper, LaFayette.....	93	Male	Died a few days after operation either from supervening panophthalmitis or shock from se-vere fright or both.
Dean, Iowa City.....	93, 93	.....	Accomplished with less trouble than with younger patients. Kept on back a very short time. One old patient died of shock.
Kirkendall, Ithica.....	92	Male	No complications. Able to read Bible daily.
Beard, Ellet.....	92	Female	Ideal result. No unusual precautions taken.
Memphis.....	92	Male	Did badly. Unstable mentally. Arteries athero-matous.
Carrow, Detroit.....	92	Female	No complications.
Howe, Buffalo.....	92	Female	Good result. Before days of cocaine.
Craig, Spring-field, Mass.....	92	Male	Good result with plus 5.00D combined with plus 2.00D cy. axis 180 gives 20/70 vision.
Calhoun, Atlanta.....	92	Female	Good result. Nothing of importance in healing.
St. John, Hartford.....	90, 92	.....	Excellent results.
Fox, Philadelphia.....	91	.....	Experience is that eyes heal better after 70 than under 70.
Park, Harrisburg.....	91	Female	Good recovery. V. 20/70. Combined operation.
Randolph, Baltimore.....	91, 91	Male	Smooth, uncomplicated. Iridectomy.
Holt, Portland, Me....	91	Male	Uninterrupted recovery.
Adams, Trenton, N. J....	90	Male	Patient in bed two days. Eyes bandaged two days.
Bulson, Ft. Wayne.....	90, 90	.....	Excellent recovery and vision. One case slow in healing.
MacReynolds, Dallas.....	90	.....	Number above 90. No unfavorable results except what mental condition would produce.
Williams, E. Cincinnati.....	90	.....	Read ordinary print. (S. C. Ayres, p.c.)
Connor, Detroit.....	90	.....	.....
Lewis, Park Buffalo.....	90	.....	Quite defective vision. Amblyopia of old age.

Operator	Age of Patient	Sex	Remarks
Posey, Philadelphia.....	90	.....	A number over 90. Never found age a contra- indication. Found inflammatory reaction less.
Wescott, Chicago.....	90	.....	Ultimate result good.
Ball J. M., St. Louis.....	90	Female	Healing uneventful. Large corneal incision. Cor- nea collapsed.
Dunn, Erie.....	90	Male	Cannot find record for results.
Hubbell, Buffalo.....	90	.....	Age <i>per se</i> no obstacle to successful operation.
Ellet, Memphis.....	90	Male	Does not consider extreme age a bar, simply as a number of years.
Kollock, Charleston.....	90	.....	Colored. Both eyes operated upon. Good results in both.
Pooley, New York.....	90	.....	Several over 90, with good results, save one with senile dementia, infected wound. Best to admit patient to hospital a day or two before the operation. Examine urine for diabetes and nephritis.

## DISCUSSION.

DR. HENRY B. YOUNG, Burlington, Iowa:—I want to take issue with the statement that those who live to great age do not often have cataracts to be operated upon. My experience is that very few live to be 85 without a cataractous process more or less developed.

My oldest patient was 87, and thus not old enough to go in Dr. Keiper's class; but now after three years coarse print is read with that eye. It was a combined extraction and a fairly smooth recovery.

DR. J. W. SCALES, Pine Bluff, Ark.:—Somewhere, in the United States, lives a doctor who read a paper on the management of cataract operation, in which he stated that he left off the bandage from both eyes and that the inflammation was so slight that he often amused himself by asking a casual observer, such as a general practitioner, which eye had been operated upon, and they could not tell. And, that he was able to dismiss his patients earlier than he would if he bandaged his eye up.

Dr. Hess, to whom the doctor had once been a private student, stated in support of the paper, that he had operated more than a thousand times with this method and was always ready to dismiss the patient by the eighth day.

If Dr. Keiper had reviewed the long line of literature of every nation upon the earth, from the father of medicine down to the gushing fountain of the original article, read at Atlantic City, he would have wept tears of bitter anguish that instead of lavishing all the power of his mighty genius, in making the statement, "It is best to leave one eye open," he would have crystallized in deathless song the glory, the fame, that should have befallen the doctor at Atlantic City, when he stated that each eye should be left unbandaged.

To those who yet will continue to bandage up both eyes, when they have the very first intimation of that developing irritation so admirably expressed by the doctor in his paper, if they will use one remedy that I believe is in line with the article of Dr. Fischer, read this morning, i. e., 1 oz. of a saturate solution of sulphate of magnesia with a pint of hot water as a bath, at the same time administering by the mouth 1/100 gr. of strychnine together with 1/100 gr. of veratrine, all irrita-



tion will vanish like dew before gleaming rays of noonday sun. If anyone doubts this remedy, let him try it in arterio-sclerosis, making the pulse the guide as to the amount of strychnine and veratrine to be used. If in further doubt, let him try it in glaucoma. If that treatment is carried out for twenty or thirty days intelligently, watching the pulse as a guide, in interstitial keratitis, in thirty days from the time he first tries it, he will doubt that it at first was a case of interstitial keratitis.

I simply direct my patient to use one ounce of a saturated solution of epsom salts, add 15 drops of carbolic acid, with a pint of hot water. I direct that to be sponged over the entire body for fifteen minutes. At the same time I give 1/100 gr. of strychnine and 1/100 gr. of veratrine, by mouth, watching the pulse until it softens slightly, then I withdraw to some extent the veratrine.

Strychnine is a vaso-motor stimulant; veratrine stimulates the inhibitory peripheral nerves. It opens the door for elimination through the pores of the skin, and the strychnine hastens this eliminating material towards the surface, and you have in the bath an excellent food for the symphathetic nerve, which is quieted down and the patient invariably goes to sleep by the time the bath is over, or, at least, you will notice in a half hour a difference in the questions the patients will ask. He is better satisfied and he is not so pessimistic. If anybody doubts it, let him try it on a child with an ordinary cold, using the epsom salts solution as packs continually around the neck. Strychnine, of course, is contra-indicated in children, but in connection with the veratrine it will afford an excellent remedy for elimination.

DR. J. L. THOMPSON, Indianapolis:—I expect every day an old gentleman of 95 to come for operation. The oldest person I ever operated on was 88, and that was thirty-nine years ago, a soldier of the war of 1812, with cataract in both eyes. He was blind in both and I operated both at once, which I do not do any more. I operated by the combined method, and he lived to be 106 years and 3 months old, and he could see to read his newspaper up to a few weeks of the time of his death. I recall a remarkable circumstance in connection. I said to him, "Mr. Hubbard, I suppose you can almost see my face?" "I reckon I can," said he, "and you are mighty ugly."

DR. ALBERT E. BULSON, Jr., Fort Wayne, Ind.:—I do not agree with the essayist on the question of a preliminary iridectomy. I cannot understand why the very aged should be subjected to two operations when one is sufficient. I have not operated on any patients over 100 years of age, but I have operated several over 85 and two over 90 years of age. So far as I have been able to determine, the healing process has been just as favorable in these cases as in those younger. Some of the best results I have ever obtained have been in patients over 80 years of age, but I have not done a preliminary iridectomy in any of these cases of advanced age, and I see no reason why these very old people should be subjected to the two operations. Not only do two operations increase the apprehension of the patient and cause us to incur more risk from shock, but they increase the possibility of infection. The resisting powers of the very aged are much reduced, and it seems to me that we should subject these patients to as little risk as is absolutely necessary in order to accomplish the desired results.

Concerning the bandaging of the operated eye and confinement of the patient to bed, I have only to say that I have somewhat changed

my former views on this subject. I remember the paper presented by Dr. Scales at Atlantic City, in which he advocated the open treatment of eyes upon which cataract extraction has been performed, and I believe that Dr. Scales deserves more credit for his courage than he has received. I have seen some of our foreign confreres, and particularly Professor Hess, to whom attention has been directed, permit cataract patients, with uncovered eye, to sit up or even walk around the room within a few hours after operation, and apparently without ill effects. This led me to believe that in certain nervous patients, and in particular the very aged, it would be permissible to give them more liberty in every way while at the same time guarding against any accident to the operated eye. At present it is my practice to give my cataract patients considerable liberty by letting them sit up on the second day, and I have no objection to the open treatment if the patient can be prevented from rubbing or in any way injuring the eye.

DR. G. F. KEIPER (closing discussion):—Dr. Young states that if a person lives long enough he will have cataract. I have had the opportunity of seeing old people in abundance at the Indiana State Soldiers' Home and a few in private practice. I speak advisedly with reference to people over 90 years of age having cataract. I have run across a number who show no evidence of cataract.

With reference to Dr. Scales' plan of open treatment for cataract, I heard the paper at the Atlantic City meeting of the A. M. A. in 1907; also the comment of Dr. Hess on it in discussion. But there was some reflection on it at the time, and those of us who were brought up under other regimen are likely to go slow. Yet it seems reasonable, and I may be able to persuade myself to leave both eyes open.

As to the bath of 1 oz. of sulphate of magnesia, is that taken internally or externally?

DR. WM. A. FISHER, Chicago:—I am in the habit of doing a preliminary iridectomy in all cases of cataract extraction, and I should like to ask the doctor what is the objection to doing a preliminary iridectomy in the case of very old people.

DR. KEIPER (continuing):—I will try that. Dr. Fisher asks why not make a preliminary iridectomy as routine practice in all cataract operations. Dr. Bulson takes the other stand.

DR. BULSON:—In the very aged, the question of lowered resisting power and natural infirmities are important factors.

DR. KEIPER:—I suppose it is on the same basis that some are old at 40 and others are not at 90. If one is not used to it, he is not likely to do it. Dr. Fisher is used to making a preliminary iridectomy in every case, and I am not. Dr. Bulson prefers to putting the patient to bed. If the patient is kept upright, it does not make much difference whether in bed or in a chair; but he will have to go to bed any way at night after the operation, and they may just as well be put to bed immediately after the operation, and during waking hours we can keep them upright with a back rest. It is simply a matter of convenience.

With reference to the preliminary iridectomy in the very aged. You make a much smaller wound than in operating for cataract. Necessarily, of course, there will not be so much shock. Some show a great deal of

shock. I have seen a patient, during a cataract operation, faint on the table though prone. It is something we want to be on our guard against. The reason that I made this preliminary operation was that I had been through the experience of losing an old man after cataract operation at 93, and you will not know how I felt unless you have passed through a similar experience.

With reference to the possibility of wounding the eye, it was impossible for me to give all the details with reference to the operation, but the point is well taken that we must guard against this possibility. I always protect the patient with a Fox shield, and fixing the patient's hands at night especially so they cannot get them above the level of the navel.

## VISUAL REQUIREMENTS OF TRAIN-MEN; SOME RESULTS OF AGITATION.

HENRY B. YOUNG, M.A., M.D.

BURLINGTON, IOWA.

In a paper entitled "Visual Requirements of Engine-men from Personal Observations in an Engine Cab," which I had the privilege of reading at the October, 1903, meeting of the Chicago Ophthalmological Society, and which was published in the *Annals*, January, 1904, I expressed the opinion, based as indicated upon the a-posteriori argument, that it was not only feasible but as well advisable to adopt less rigid standards than those tentatively agreed upon by all the parties interested, and at the same time depend on practical as against technical tests.

To the best of my knowledge and belief this was the first contribution of its kind to ophthalmic literature, as the work, which inspired it was the first undertaken on railroad initiative looking to a demonstration of the practical features in vision tests for railroad trainmen. As the years have passed my work has been reviewed by other observers, with more or less elaboration, but without essential modification of my findings.

At the annual meeting of the Iowa State Association of Railroad Surgeons in September, 1906, I essayed to fortify these conclusions by an a-priori argument. This argument may be found in the December, 1906, issue of the *Railway Surgical Journal*, but so far seems to have escaped the critic's eye.

In this argument I called particular attention to two facts, viz.: (1) The average semaphore "board," built, as it was, upon a faulty scale could not typify 20/20 at one-half mile. (2) Objects drawn to scale for distances greater than twenty feet can usually be deciphered at a distance greater than the scale number.

As a side issue in this connection it may be pertinent to ask whether, in view of the fact that diminished test objects (as seen in the refractometers) equally with those enlarged, lead to inaccuracy in estimates, it would not be better to use the twenty-foot letter exclusively and make it the denominator in our fractions?

Thus in a sense the work, which in the beginning was a search for an exception to the rule for the benefit of a single individual, developed into an attempt to provide a solution of difficulties in general. At the inception, some ten years ago, of the movement to establish systematic examination of trainmen's eyes, and the consequent elimination of defectives, the great obstacle to progress, as we all know, was the fear of railroad managers that it could not be inaugurated without more loss than gain. There would surely be friction with the old employes and through this business could hardly escape demoralization.

For two or three years very little progress was recorded. Then out of a very small incident, the failure of one long trusted man to maintain the standard of visual excellence, came the opportunity to get at the situation in a different way; the opportunity to demonstrate that the element of friction with the old employes could be relegated to the discard.

Time after time, while making my observation, was it said to me by the men: "Now you are getting this thing right. By putting yourself in our place you get a working knowledge of the peculiar things in the business and will understand why we criticise standards and methods."

This was the entering wedge. To the insistence, however, upon the rule, suggested by bearing the other man's burden, that "field tests" should be the ultimate guage of visual competency, can be traced the feeling of absolute fairness in the tests which now prevail among the men.

It may not be known to many of you but it has not been so long since the exercise of this rule, by a trunk line executive who was at first disposed to make light of it, promptly dissipated a controversy, which was rapidly assuming serious proportions. Through it both parties saw at once and together where each had been at fault and concessions followed.

The removal of this feature of the great obstacle—friction with the men—has naturally made smoother sailing for our contention. As ophthalmologists we have, in a measure, "made good" in railroad circles. "Surgeons and oculists" now constitute the "staff" on many roads; and when we can demonstrate that the more complete examination can be made at trifling expense we will be in line for further consideration. Until then we have to be content with the practical disappearance of the prejudice against glass wearing and the addition



of control tests by the employment officers, who on one trunk line at least are attached to the medical bureau.

In the meantime we may perhaps find ourselves somewhat on the defensive through the advent of unexpected bi-products, one of which has already arrived.

It seems to be the fate of reforms in general that they excite the interest of some who are simply altruistic for entertainment, and win the support of others whose enthusiasm surpasses their discretion. In this instance we may note the usual experience in the work of two state legislatures, which, doubtless conversant to some extent with our action, have supplemented our efforts with laws calculated to eliminate one factor in our problem.

An estimate of the visual requirements of train-men necessarily includes a consideration of the signals used, night as well as day, and the effect of the electric headlight both upon the signals and the eyes of the men. It was upon the headlights that the attention of the law-making bodies was riveted. In Montana the law deals wholly with character—headlights on all road engines must be no less than 1500 c.p. measured without reflectors. In Indiana the law authorizes the board of railroad commissioners to act in this regard and this board has ordered electric headlights on all road engines. Compliance with the Montana law does not inflict so many hardships as the order here.

There are not so many engines to be equipped and both oil and acetylene may yet be brought to standard. One firm has already shown an oil light said to have 2000 c.p. with a reflector. The designation, moreover, of one particular headlight for Indiana might be taken as a challenge to the railroads to show what more they knew about safe and efficient appliances than the public servants; and a decision to oppose the order followed.

To that end a commission of twenty-five, of which it was my fortune to be a member, was assembled in this city last September for the purpose of making observations on the comparative values in oil, acetylene and electric headlights and whose report should be the basis of injunction proceedings before a master in chancery of the United States Court. This commission devoted three nights to the allotted work, which was grouped as follows:

Tests on certain arrangements of block and other signals to be unknown to observers and made under various conditions of opposing and approaching headlights; observers to ride in

observation car ahead of engine and stops made at known distances, with record at each stop;

Tests of similar character except that observers ride on observation locomotive which allows greater speed, each observer equipped with stop-watch, starting the watch when signal is first fully seen and stopping it just as the signal is passed;

Tests of similar character on track obstructions and the obstructions photographed at the same time for comparison;

Tests on estimates of distance, the observers on the ground and various headlights moved back and forth at intervals and stops indicated by whistle blasts;

The tracks of the Big Four Railroad from Avon Station east for a distance of 6000 feet were provided for these tests. These tracks were staked off in sections of 100 feet each and special telephone service installed over this course for whatever communication might be needed between the observers and those in charge of signals and opposing lights. Separate record sheets were also furnished for each test and to each observer.

In all there were sixteen tests with an average of three aspects to each; which is evidence that in the time given to it the work was arduous as well as interesting. That it was instructive is a statement that should only be made with qualifications. Its purpose was too definite, and the demonstrations, under the management of a railroad official who had that purpose constantly in view from the economic standpoint, naturally lack scope.

For instance, we were shown that in the face of an opposing electric headlight a track obstruction back of it should not be seen within the limit of a momentum of thirty miles an hour; likewise, that with a momentum of sixty miles an hour the ordinary lamp or semaphore lights would be visible less than ten seconds before they were passed; and that while it was possible to reasonably locate an approaching oil headlight, the acetylene was attended with uncertainty, and the electric brought confusion. But no attempt was made to show upon the eyes of the observers the effect of exposure to these lights; and this is the more remarkable because of the fact that a record of the observer's vision was made before this exposure.

In a legal controversy where the burden of proof is so heavy on the proponent, this omission can hardly be accounted for on any other ground than that the eastern trunk lines who brought the action are not so conversant with the subject in its various

bearings as those in the middle West. Whether it was a fatal omission is problematical, because such legislation starts out with a good standing under the police powers of the state. The public, moreover, has little regard for scientific issues (medical or otherwise), which effect so small a number as that composed of engineers and firemen and the more especially when this small number makes no complaint. Besides this, fully one-half of the objections to the electric headlight can be overcome, except on double-track roads between stations, by the turn of a lever on the opposing engine. In spite, therefore, of all the commission can say, or might have said, the railroad case is none too strong.

The preparation for it has been attended with a considerable expenditure of time and money, and in the event that the perpetual injunction prayed for is denied, there must be a further large expenditure for the equipment demanded. For this some one must pay and it may be that our depreciation of such legislation will not pass current. All in all then, the results from this as from other agitations for measures looking to the general welfare are but partially compensatory; and when we consider the suspicion held by some, that our motives have not been wholly disinterested, a comparison is inevitable between the prohibition of unsolicited service to the individual and the approval of a similar service to the aggregate.

## DISCUSSION

CHAIRMAN:—Can these reports be obtained by members of this Association?

DR. YOUNG:—I have been told that they will be available, but I have made every effort possible to get copies of the observation sheets which I myself made and have not succeeded in getting them.

DR. RISLEY:—Will Dr. Young give us a frank, clear statement of his own estimate of the relative value of oil, acetylene and electricity, as viewed from the practical or railroad side?

DR. YOUNG:—That is the very thing I declined to do for the railroads; because until I had a chance to digest my notes I felt that I was not prepared to do so. A great deal can be said for and against the electric headlight. I think that without doubt a large majority of the engine men prefer it above all others, although they may not be able to give the real reason for this preference. In the illumination which under ordinary conditions, makes the night more like the day there is naturally pleasure and satisfaction; but underlying these there is just as surely a sub-conscious feeling of greater safety to themselves in the event of track obstruction. They have a better show for the "get-away." It is not that they are indifferent to the fate of those behind them—there

is simply the greater risk; and they will do everything possible for the others before they jump.

When there is "falling weather" (rain or snow), as I pointed out in my first paper, there is a reflection from these lights on the falling particles, and signals are thus obscured. Besides this, in approaching unlighted signal lamps or other bright objects the rays may so impinge that they give "phantom lights" of various colors.

With so much to be said for and against the electric headlight, it seems unfortunate that an attempt should be made by untrained men to settle by law an issue in which the element of greater safety is a relative quantity. The goal of all railroad managers is the safe and efficient operation of their lines, and they may be depended upon in general to adopt measures which painstaking investigations have shown to be practical. In estimating distance for oil illumination I think my greatest error in all the six stops up to 6000 feet, was 150 feet.

DR. RISLEY:—I wish to inquire of Dr. Young if the United States government still adheres to the oil lamps in its lighthouses as a source of illumination?

DR. YOUNG:—Yes, I think so.

DR. RISLEY:—There are certain considerations which seem to throw side lights upon the subject under discussion. For example, there are many conditions in the eye, where I personally prefer the yellow gas flame for study with the ophthalmoscope or by oblique illumination. It seems to penetrate a steamy cornea or a hazy vitreous better than the electric lamp. In this connection I recall an experience with an old gentleman who was interested in the installation of gas plants. He insisted upon demonstrating to me on a foggy night that the ordinary street gas lamp could be seen farther on such a night than the electric arc lamp then in use in the city and which represented much greater candle power than the gas lamp.

DR. RAISON, of the United States Navy:—I did not expect to take part in the discussion because I am not a specialist. However, our requirements in the navy are similar to those of train men. Two or three years ago we used the Snellen card. Later we adopted a card with the letters to be read at twenty feet, and find these much more satisfactory than the old cards, as the men used to memorize these old cards. I do not think there is a Snellen in existence, but that if you will give me the start I can say backwards or forwards or from the center. But in the new cards where we have eight letters at twenty feet, it is impossible for any man to memorize it, for it can be read vertically, diagonally or perpendicularly. It was devised by E. J. Groh of the navy, and is now used everywhere in all our tests.

Speaking of blinding lights affecting a man's color perception, in Oklahoma they had a snow storm and it lay for weeks on the ground. Ninety per cent of all applicants in that time were color blind. In my experience in examining for two years in the winter, in examining men on coming in from a snow storm, 90 per cent of these will be found color blind, especially for rose or violet. That is also true of men from the fire engine. If they suddenly look into a searchlight they become momentarily or for a little while red or rose blind.

In looking over the subject to be discussed, I looked over the Surgeon General's report this morning and my own reports of examinations for the past two years and made a note of them. In the Surgeon General's

report for 1908, 48,648 men examined; 25,000 were accepted. Of the number examined, 1486 were color blind, giving a rate of 29.51 per thousand examined. In 1901 there were 22,000, of which 1034 were color blind, giving a rate of 31.08 color blind. In my own examinations I have found a higher rate. My rate runs about 7 per cent. It may be I am more interested in color work than some men, or it may be the nature of the country. I also was surprised in looking over the report of 1909 and 1910, to note that most of our color blind men were those with light irides. I rejected 114 men last year on account of color blindness, 38 of whom had gray, 31 blue and 8 hazel eyes, giving a percentage of 66 with light irides. This year 96 were rejected, of which 68 had light irides. I do not know whether color has anything to do with color blindness or not. I used the Holgram test and also Black's. I have never found a man yet who picked out the grays correctly. They will go into the pinks, the greens, etc. This seems to give an indication of man's color perception.

DR. NELSON M. BLACK, Milwaukee:—As stated by Dr. Young, the comparison of the semaphore blade at one-half with one line of 6/VI (20/20) V letter is not absolutely exact, but within safe limits for all practical purposes, and when you take into consideration that (as shown in comparatively recent filed tests at Noble, Ohio) an individual with V O.D. 20/50 V O.S. 20/40 could indicate the position of the semaphores at 4000 feet combined vision and at 2500 feet with the poorer eye, another with V O.D. 20/40 V O.S. 20/70 combined, semaphores at 2800 feet poorer eye 2100 feet; another with V O.D. 20/70 V O.S. 20/50 combined semaphores at 2500 feet with poorer eye 1600 feet; V O.D. 20/100 V O.S. 20/50 combined semaphore 2000 feet poorer eye 1100 feet; another V O.S. 20/100 V O.S. 20/70 combined semaphores at 2500 feet with poorer eye 1800 feet, it shows conclusively that office tests do not give an idea even of the *absolute visual acuity* of an individual.

Besides this the field test discovers other factors which the office test does not, such as defects in color vision, night blindness, etc., often showing men apparently safe with an office test are not safe on the road.

Dr. Risley spoke of his ability to see gas lamp rays in certain weather conditions at a greater distance than the arc lamp rays. This is due to the fact that the rays of long wave length have a far greater penetrating quality in fog than those of shorter wave length or even those of white light. For this reason illuminants having a preponderance of yellow rays are used in lighthouses.

Dr. Raison referred to temporary rose blindness, the result of looking into a bright light. That I think could be easily explained as a result of bleaching of the visual purple, which, until it was reproduced fully would cause rose blindness. The same reason may account for more color blind being found in those with light irides; i. e., less pigment generally throughout the system with a poorer quality of visual purple.

DR. NEWCOMB, Indianapolis:—I shall accept the courtesy of the floor offered me, and will say that I had the pleasure of being on the same tests as Dr. Young last September, and would add that the reports of the tests have been put into available form, and I would be glad to show them, as I have them in my office. They give the actual observation of every man on the locomotive. One thing spoken of by Dr. Young was that there was no attempt made to ascertain the actual effect of the bright light on the eyes of the men on the locomotive. There was a request made that everything observed be noted on the sheets, and in



the testimony given here the following month in the federal court the question was brought out thoroughly, and the point brought out that at night and during prolonged tests the retinal fatigue was marked. After facing one of the electric headlights, I had to wait three minutes before I could make my findings on account of the negative after image. My impression is that all observers made reports at some time of phantom signals. At a certain angle the engines' rays were thrown into unlighted lamps, giving the same effect as though lighted, and it persisted for some time. There were three engineers on the New York Central Lines suspended on account of the phantom lights they saw. The classification signals on an approaching train, the engine bearing the classification signals we all noted, as we came down the track, with a request to make note of everything we saw, but very few made all these. The testimony brought out before the court showed the utter impossibility of stopping a standard train of six coaches with seventy pounds pressure when opposed by an electric headlight. At twenty miles an hour the engineers would be enabled to stop with either electric or oil equipment. The photometric observation showed the acetylene light possessed a higher power than the oil, but under actual test this was very little.

Along these lines I constructed a miniature electric headlight and made my semaphore signals according to Dr. Black, and then substituted the oil lamp, using the standard oil, and in this oil test the findings of the field test were borne out fairly accurately. I would be happy to show these reports.

DR. H. B. YOUNG (closing):—I think that most of the points raised by my paper have been covered by the men who have taken part in the discussion. I agree with Dr. Risley about the oil or gas lamp for ophthalmoscopic illumination. Dr. Raison's remarks in connection with the twenty feet letters as the exclusive test in naval examinations reminds me that my knowledge of this practice should have been mentioned. The scale drawing referred to by Dr. Black will be found in the *Railway Surgical Journal* as quoted. I would simply add that in testing myself on a series of test letters my vision was relatively better at 500 than at twenty feet by a decisive fraction. Dr. Black's remarks on "white lights" reminds me that I am doubly unfortunate in not having copies of my observation sheets in the headlight tests because I made observations with amber as well as clear lenses, which would enable me to give comparative results. In reply to my Indianapolis associate in this work I still maintain that definite tests for fatigue were not a feature, and it was not mentioned in my presence. Bodily fatigue was in evidence, for the work was strenuous. We went on duty at 7 P. M. and the earliest return was 4 A. M.; once it was 4:30, and once at 5 A.M. As the majority were not accustomed to looking for signals from such view points, or working nights and sleeping days, I held the work too strenuous and registered a protest to this effect. I suppose that is why I was not called upon to testify in court.

One feature of my paper was not discussed. Those who read between the lines can see that the topic treated is largely a vehicle for a warning against present day medical activities which assume to be altruistic but have a pendant string. I selected this topic because I was better acquainted with it, but the argument is applicable to other issues; from that of making general practitioners refractionists, to that for a department of Public Health with a doctor in the Cabinet. That all of these movements are innately meritorious I freely admit, and they would have my cordial support were it not for the fact that they all incidentally

include a material profit to the promoters sufficient to arouse public suspicion. As members of the regular profession, we take just pride in the fact that we are the only people on earth who have done things to make life and health more secure through the prevention of disease; and we may properly claim some consideration on this account, because our only reward is the satisfaction in a duty well done. But here the analogy fails. The cabinet doctor is to have a desirable salary, with assistants ditto (all regulars), plus patronage; every regular is to attempt refraction for the dollars which will otherwise go to medical imitators; and the railroads are to help *us in particular*, at least to positions of influence. It is not so long since my attention was called to the utterances of the junior senator from California in opposition to the Public Health bill, and I am satisfied that his long-drawn argument would never have gotten such effective support had it not been for the *quid pro quo* in the measure. Under these circumstances it is not surprising that the League of Medical Freedom has grown to such proportions, and should include in its membership some people of real influence. But add to this the almost public scandal of fee-splitting, and the almost public adjurations of the official organizer of the A. M. A., anent the power we might wield, and it is still less surprising that we find the people deaf to our advice. I believe in altruism, but not that where one open palm is behind the back.

The paper, in a sense, is a reply to those who in times past have intimated that my role was that of obstructionist.

CONCERNING UVEITIS (AND DESCHEMETITIS IN  
PARTICULAR) AND ITS PROBABLE RELATION  
TO LATENT NASAL OBSTRUCTION.

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It is no longer necessary to argue the relation existing between inflammations of the *extraocular* tissues and disease of the nose and its accessory cavities. Doubt has given away before the brute force of the facts and figures now at hand concerning this relation. Scientific inquiries are now devoted, not to any further proving of the existence of the relation, but to establishing the path taken by the infection and its mode of transmission. We are in possession today of many fairly definite facts concerning the anatomy of the bony parts concerned, and of the arterial and venous connections; and the presence of lymphatic channels in the orbital and periocular structures has been shown presumptively at least. To this reference will be made later on.

Evidence must now be accumulated as to the definite casual relation between sinus affection and *intraocular* disorders. That such relation does exist is more or less definitely claimed by a goodly number of workers; that its existence is strongly suspected by a much larger number of investigators is quite as true. To add some clinical evidence to the probability of the existence of this interdependence is the object of this communication.

One thing that perhaps more than any other inspired the presentation of this report, is the obscurity attending the etiology of many cases of uveitis. For instance, De Schweinitz classes the causes of uveitis as "dietetic, toxic or infectious." He goes on to say: "A certain number of cases depend upon constitutional diseases, for example, rheumatism, gout, diabetes; or specific infectious diseases such as influenza, syphilis, gonorrhea, tuberculosis, scrofula and specific fevers; on diseases of the blood such as anemia; on anomalies of the urinary secretion, for example, lithemia; on local diseases, especially those of the pelvic region and of the rhinopharynx and accessory sinuses." Weeks' belief is that "that uveitis is probably caused by the action of toxins on the vascular tunic of the eye, the toxins having their

origin remote from the eye and circulating in the blood, or from micro-organisms situated in the tissue of the eye." He further states that "uveitis accompanies rheumatism, gout and diabetes." He quotes W. Stock (*Graefe's Archives*, vol. LXVI) to the effect that "tuberculosis is the most frequent cause." Syphilis, gonorrhea, influenza and the infectious diseases are all held responsible. Quite a percentage of cases are ascribed to local microbic activity, as ulcer or abscess in the pelvic cavity, nasopharynx and alveolar processes; and diseases of the blood are held responsible for a small number of cases."

According to Fuchs, who believes there is practically no simple iritis without involvement of the ciliary body and choroid-iridocyclitis or uveitis anterior, the same may be due to either general or local causes. Under general causes he mentions syphilis, scrofula, tuberculosis, rheumatism, gonorrhea, acute infectious diseases and diabetes. As local causes he enumerates idiopathic uveitis (whatever that may be) and traumatic and sympathetic uveitis. Finally, E. Treacher Collins firmly believes that these are all cases of cyclitis, especially since his discovery of the glands of the ciliary body, his idea being that uveitis (or some other serous iritis of the older writers) is primarily a catarrhal inflammation of these glands which, by oversecretion, augment the aqueous humor, with distension of deepening of the anterior chamber. "The purely lymphatic character of the aqueous thus undergoes alteration and can be shown to contain leucocytes, pigment cells and fibrin, all of which mixed elements are deposited in more or less regular forms on the posterior or endothelial layer of the cornea." Unfortunately for this view it is not uncommon (if the media are moderately clear) to find patches of recent or very active choroiditis (generally pretty well forward) so that some more widespread cause is at work than a simple catarrhal inflammation of the ciliary glands.

If I have dwelt somewhat at length upon the causes and nature of uveitis held by these four distinguished writers (representing the German, the English and the American viewpoint) it is because I wished to show that where so many etiologic facts are mentioned, we may be sure exact etiology of the disease is not yet definitely known. Noteworthy, however, is the fact that the two American authorities specifically mention diseases of the upper respiratory tract as possible causes, while neither of the foreign authorities so much as allude to it. Strangely enough, Fuchs comes very close to making such a statement in

his definition of *idiopathic (?) iritis* wherein he says: "By this we mean those cases which seemingly develop of themselves without any apparent cause (injury, etc.). *In many cases a cold is blamed for the condition*, but in most instances the real cause remains in the dark." How close this statement may be to the absolute truth, only future developments can prove.

The type of disease under discussion begins insidiously with slight haziness of the cornea and aqueous humor and corresponding reduction of vision. Within a few days a fine precipitate may be discovered on the posterior surface of the cornea generally of triangular arrangement, with its base at the lower limbus. There may or may not be a bit of pericorneal injection. Some claim the tension is a trifle elevated in the earliest stages of the disorder, but of this I have not been able to entirely convince myself. After the disease is established, the tension is almost invariably lowered. The essential sign, the triangle of dots on the endothelial surface of the cornea—while most characteristic of uveitis—is generally present as a more or less marked descemitis in nearly every case of so-called simple iritis if carefully searched for. In addition to this, the vitreous is generally hazy and contains fine granular or stringy opacities. The choroid seldom fails to show some manner of lesion.

There are a few very significant facts in relation to uveitis that are seldom touched on in the literature, namely: 1. It is a disease that seldom occurs in children.

2. It is most frequent in young adults and fairly common in older subjects, especially those of advanced age, when it pursues a quite low form with a few spots on the posterior corneal surface and some vitreous opacities.

3. It is more frequently monocular than binocular. Weeks is also of this opinion, and it is a fact that should give us pause; the more so as we have come to believe in a general way that many distinctly one-sided ocular affections are very much more likely to be of focal than general origin.

4. There seems to be little tendency for the second eye to become involved.

5. Those forms of uveitis due to general constitutional disorders usually appear in both eyes at about the same time; and as a rule give rather frank evidence of the etiology of the ocular disease.

6. The unilateral cases are commonly of very obscure origin unless one follows up the possible nasal or sinus origin of the



trouble. In this event they are very likely to find that a seemingly idiopathic uveitis proves to be plainly of focal origin.

The literature concerning *extraocular* affections due to nasal and sinus disorders has assumed colossal dimensions. Onodi in his monograph deals with a literature covering 205 communications; while Birch-Hirschfeld's recent volume in the second edition of the *Graefe Saemische Handbuch* catalogues a bibliography embracing 721 titles! In our own country the work of Holmes, Cryer, Loeb, Francis and Gibson, from the anatomic standpoint, and a host of workers from the clinical standpoint, have enriched our knowledge of rhinogenic ocular disorders.

The literature concerning nasal and sinus disorders and the *intraocular* conditions they may produce is as yet reasonably limited. A few foreign observers have written of uveitis due to obstructive nasal disease, and perhaps half a dozen have mentioned asthenopic symptoms as secondary to nasal obstruction, prominent among these being Zeim and Nieden. In our own country Zeigler, Posey, Manning Fish and many others have brought this subject prominently before the ophthalmologic profession.

For many years the etiology of low grade (almost non-inflammatory) uveitis has been the subject of much controversy because of its obscure origin. Usually it proves very rebellious to treatment. Latent nasal obstruction has been mentioned from time to time as a possible causative factor, but this belief has not been generally accepted. For instance, in his communication before the Section of Ophthalmology of the American Medical Association at the 1905 meeting, Posey remarked: "When the enormous extent of mucous membrane which is spread over the nose and its sinuses is taken into consideration, and account made of its large venous and lymphatic channels and the very close and intimate association which these vessels have with the blood vessels and lymphatics of the eye, it seems extraordinary that the eye should not be the seat of active inflammatory processes in all cases of sinusitis and that the uveal tract especially should not be frequently involved. And yet it would appear, despite the claim of Zeim and others, that involvement of the interior of the eye either by emboli or direct infection is very rare. The thought occurs that there may be some peculiar arrangement of the vessels of which we are as yet unaware, which protects the eye from participation in these inflammations." Elsewhere the same author says (*Old Dominion Jour. of Medicine and*

*Surgery*, November, 1909): "Despite the close and intimate association which the blood vessels and lymphatics of the nose and its sinuses have with the similar ocular structures I have never been able to assure myself except perhaps in one instance that an inflammation of the uveal tract had actually arisen from sinusitis. It is true that in a number of instances I have seen cases presenting this type of ocular inflammation improve under nasal treatment, but mere fact of such amelioration is no actual proof of the dependence of the ocular inflammation upon that within the cells, and it seems to me that a more intimate knowledge of the pathologic relationship of the parts is necessary before it will be proper to subscribe to the claims of Zeim, Fromaget, Fish and others."

Our knowledge of the blood vessels and lymphatics of the nose is relatively thorough. The same may be said of the blood vessels and lymphatics of the eye itself. Concerning the blood vessels of the orbit, those which concern us most are the veins, as they are likely (along with the lymphatics) to be the channels along which infection would travel.

According to Gurwitsch, the superior ophthalmic vein (which is the main venous outlet of the orbit) receives the following veins:

1. A vein from the lachrymal sac.
2. A vein from the frontal sinus.
3. A vein from the antral plexus.
4. A branch from the inferior ophthalmic vein.
5. A branch from the angular vein.
6. The anterior and posterior ethmoidal veins.
7. The muscular veins.
8. The vein from the lachrymal gland.
9. The *venæ vorticosæ*.
10. The central retinal vein.
11. Veins from the optic nerve sheath plexus.
12. Small branches from the orbital fat.

The superior ophthalmic vein, therefore, drains an extensive territory. Krauss' and Birch-Hirschfeld's investigations both show that the blood from the eye and orbit has a very free passage forwards or backwards because of the *almost complete absence of valves in the veins*, and that the amount of blood making use of these channels probably depends largely upon the position of the head at the time. Hence, it is not difficult to conceive how infective material (either micro-organisms or their

toxins) may gain entrance to the eye through the communicating veins to the vena vorticosæ, the central retinal vein and the optic nerve plexus by way of the superior ophthalmic vein when there is such ease of passage from one set of venous trunks to the other unhampered by valves. Indeed, the weight of evidence seems to indicate that venous blood in the orbit is not only constantly being augmented from the nasal mucosa but by filling the venous plexus that practically surrounds the eye makes infection of the intraocular structures quite possible.

When we come to consider the lymphatics the evidence is not quite so conclusive. However, the recent researches of Birch-Hirschfeld demonstrate the presence of lymph spaces in the orbital tissues of rabbits, dogs and apes, and the evidence he submits as furnished by pathologic human specimens lends the strongest presumptive evidence to his assumption that such spaces exist in the normal human orbital tissues. The mucosa of the cephalic mucosa (or the mucosa of the nose and sinuses) is reasonably rich in lymphatics; the eye contains two moderately large lymph spaces posteriorly (the hyaloid lymph sheath and the optic nerve lymph sheath) and two large ones anteriorly (the posterior and anterior chambers). Both of these latter are in relation with the venæ vorticosæ by way of the choroid and ciliary body, and the venæ vorticosæ as already mentioned anastomose with the veins from the nasal mucosa by way of the superior ophthalmic vein.

Within the past three years I have had occasion to study a number of cases that strongly suggest the association of nasal and intraocular disease and they will be here presented with such comment as they deserve.

Case 1. Mrs. C. M. C., aged 35, had been twice refracted by me, at which time all the intraocular tissues were in normal condition. Four years ago she presented herself one day with a history of gradual dimness of vision in the right eye, that had been a week in developing. It had come on without pain and without much external sign of inflammation. Her vision which had always been normal, had fallen to 3/60. The conjunctiva was a trifle œdematous, there was a slight pericorneal blush and the cornea exhibited a most perfect cross hatching. The eyeball was somewhat tender to pressure and the tension about — 1. The other eye was absolutely normal. No possible etiologic factor could be made out. Indeed, the woman was in perfect physical condition, the only point of suspicion being that ten

weeks previously she had been confined to the house with a typical attack of influenza. This implicated the nasal passages and sinuses by suspicion at least. Nasal examination revealed a much engorged right middle turbinate impinging on the septum. The left nose was practically normal. The local treatment consisted of atropin, dionin and hot stupes with added general treatment of a course of calomel and a tonic. One week later there was very little if any improvement and nasal treatment was suggested, to which she demurred. She finally consented, however, to the internal use of atropin to the physiologic limit and spraying the nasal cavities with cocaine and adrenalin. Within a week the vision had risen to 5/30, the cornea was much clearer, the pericorneal blush and conjunctival œdema gone. Because of these things, surgical nasal treatment was once more urged and finally she consented to have her family physician (who was somewhat of a rhinologist) cauterize her middle turbinate body. Within one week after, her vision equaled 5/10, the cornea was almost entirely clear, a few fine vitreous opacities remained. One week later vision was normal, and as the media were now entirely cleared, search was made for any areas of choroiditis that might have been present, but none could be found. In the intervening four years there has been no sign of occurrence.

*Remarks:* Lattice (or cross hatched) keratitis is usually very slow of recovery. Complete recovery in three weeks without mercury, iodine or salicylates, and with persistent nasal treatment is suggestive, to say the least.

Case 2. K. I., aged 23, a tall, thin, pallid, anemic looking young woman, seamstress by occupation, came under my observation October 15, 1908, with a history of blurring vision of gradual development (about two weeks) in her left eye. She was the subject of chronic constipation and the urinalysis revealed a high indican percentage. The blood count showed 3,700,000 red cells—hemoglobin 85 per cent. Her heart and circulation were in good condition and she was pronounced by a good internist as a fairly healthy young woman, free of organic disease. There was no history or suspicion of syphilis.

The right eye was normal in all respects. The left eye showed vision of 5/15, cornea smooth and regular—no pericorneal blush, pupil 3 mm., rather sluggish of reaction. Under 1 drop of homatropin solution the pupil dilated regularly to 6 mm. and a fine deposit on the posterior surface of the cornea, almost central, was made out. Through it a few vitreous opacities could

be discerned, but the fundus details were too much obscured to be studied. Ocular tension was doubtful — 1. Nasal examination (reported by a rhinologist to whom she was referred) revealed tumefied middle turbinates—with large contract points on left side, readily reducible under cocaine. Cauterization of the turbinates was proposed, but declined. She was, therefore, put upon the classic treatment of atropin, dionin, hot stupes, a course of calomel and a tonic. Locally in the nose a cocaine adrenalin spray was used and internally atropin in full doses. One week later the vision was 5/12 and the ocular conditions somewhat improved. Five days later the vision rose to 5/9 and the ophthalmoscope now revealed a patch of plastic choroiditis very well forward and directly below. About this time she felt a trickling sensation in her left nostril and on using her handkerchief found what she called “a little corruption and some blood” in it. Within a week vision had risen to 5/4, the media were absolutely clear and the patch of choroiditis seemed to have become perfectly quiet. Duration of treatment three weeks, lacking a day or two.

*Remarks:* Anterior uveitis associated with choroiditis has a marked tendency to run a protracted course as is well known and the fact that this young woman, whose vital resistance was below par, recovered full vision in three weeks is worthy of consideration.

Case 3. A. C. B., 35, married, inventory clerk, admits infection three years ago. Had been skillfully and constantly treated throughout the three-year period by a well-known internist. I first saw him September 2, 1910, when he was referred to me on account of a refractive error. His vision was found to be 5/9 in either eye, the media were clear and the fundi normal. With 0.75 cylinder axis 180 degrees in each eye, his vision equaled 5/5 in the right eye and 5/6 in the left eye. With this prescription he was dismissed from observation. One month (to the day) later, he appeared again, saying that his left eye was troubling him. His corrected vision was normal in all respects. The left one presented a faint pericorneal zone, the cornea and aqueous both seemed a little bit turbid, and under homatropin a few discrete spots were found on the posterior surface of the cornea somewhat down and in from the center. There was a little pain in the eye, some tenderness on pressure and the tension was — 1. Under questioning it was learned that for a fortnight he had been having a heavy cold, but he had become so morbid



on the subject of his infection that he ascribed his ocular trouble to that source. No Wassermann was done, as he was at the time suing his wife for divorce and he refused to take the chances of so incriminating a bit of evidence as might be consequent upon the finding of a positive Wassermann. The nasal examination revealed no abnormality in the nasal passages. He was nevertheless placed upon the cocaine adrenalin spray and the usual atropin (internally and locally); dionin, heat and the continuance of the antispecific treatment.

In 17 days the eye was normal in every respect.

*Remarks:* There is much room for reasonable doubt whether in this case the syphilitic infection may not have been operative. If so, it is rather unusual for the uveitis to have developed at the end of three years faithful treatment. True, parallel cases occur in which outbreaks occur during the course of treatment, but they are rare to say the least. Moreover, 17 days is a very short period for a uveitis to endure.

Case 4. Concerns a married man of 49, who five years previously (to November 7, 1910) had been refracted by me with resulting vision of  $5/4$  in each eye. He showed 2 degrees of exophoria for infinity and 4 for the reading distance, with a convergence near point of 3 inches. He was a superbly proportioned man of rugged constitution and good life habits. I saw nothing of him for four years, when he returned one day to say he had been through a seige of acute tuberculosis, having gone off 31 pounds. Residence at Asheville, N. C., and treatment with tuberculin had quite restored him so that for two months he had been back at his desk in an administrative capacity. He was then refracted again with vision of  $5/4$  resulting in each eye. This was in December, 1909. November 7, 1910, he reappeared, saying his left eye had been uncomfortable for two weeks. I found the right eye normal with vision of  $5/4$ . The left one seemed normal anteriorly but showed vision of  $5/9$ . There was some tenderness to pressure, no tension, seemingly no exophthalmus but the Hertel exophthalmometer showed 4mm of proptosis in the left eye. Under homatropin three tiny central spots were discovered on the posterior surface of the cornea and there was a Y-shaped floating string of opacity in the vitreous, in length about one-half the diameter of the disc. The nerve head was slightly suffused and the retinal veins unduly dark and tortuous, especially the inferior distribution. The left nose was very narrow, a hypertrophied middle turbinate

being jammed over against a septum that was deviated to the right so that the right fossa also showed much obstruction. He was advised to consult a rhinologist for surgical correction of these conditions, but flatly refused. His physical condition was excellent. The treatment was identical with that outlined in the three previous cases (with the exception that the atropin solution in the eye was omitted), including the nasal spray of cocaine and adrenalin, which was later followed by a strong menthol spray. By the 30th of December his left eye was normal in every respect and he had been at his desk every work-day of the intervening time.

*Remarks:* The question may well be raised as to whether this was not a local manifestation of his tubercular trouble, the more so as tubercular uveitis is far from uncommon. But the prompt manner in which the low grade uveitis responded to treatment (and that, too, without the use of one drop of atropia) leaves quite as much room to question whether it was not of nasal origin. I would put this down as a case of doubtful etiology, with the chances about even as to nasal or tubercular origin.

Case 5. P. S., single, age 22, bookkeeper, in good health, stated September 27, 1910, that for one week his left eye had been feeling queer. Three weeks previously he had had a very heavy cold in his head. Denied infection. Anteriorly both eyes seemed normal. Vision equaled right 5/5, left 5/6. Under homatropin the right eye presented no abnormality. The left one showed a beginning uveitis with a few characteristic spots on the posterior surface of the cornea, marked congestion of the chorioid, slight swelling of the nasal half of the disc and beginning edema of the neighboring retina. The vitreous was clear. The visual field for form and color was cut down concentrically from 10 to 15 degrees all around. There was no scotoma. The treatment was dionin and heat, locally atropia in full doses by the mouth, a nasal spray of cocaine and adrenalin, and 1/16 grain of biniodide of mercury three times daily, on suspicion. The urinalysis was negative. Recovery went on quietly without incident and in three weeks the eye had returned entirely to the normal.

*Remarks:* Whether the healing would have gone on just as uneventfully in this case had biniodide of mercury not been used is of course problematic. At all events, he took biniodide but three weeks and there were no stigmata of syphilis either

before or since the treatment. It is worthy of note that the young man was away from his office but two weeks altogether—a very important point from the patient's standpoint, at least.

Case 6. Recurring iritis. G. C. O., single, aged 30, hosiery manufacturer, first seen December 23, 1897. Gave a history of an attack of iritis in left eye three years previously. This attack had lasted ten weeks, three of which had been passed in bed. Finally made a perfect recovery. Patient a splendid specimen of physical manhood. Very athletic. Lives a model life. Denies infection. Comes of pronounced gouty stock on both sides. Vision equaled 5/5 in both eyes. O.D. normal. O.S. beginning iritis. Treatment of atropin and heat locally, and good elimination instituted promptly but in spite of all measures developed a florid iritis which was ten weeks in subsiding.

For about two years he went along without any trouble when suddenly November 24, 1900, the right eye flared up into intense iritis, notwithstanding his most careful methods of life. The only noteworthy fact was that there was a high indican percentage in the urine. As in the preceding attack, the iritis ran through its full cycle in spite of the most energetic local and general treatment, but this attack endured only six weeks instead of ten weeks.

January 29, 1902. Second recurrence in O.S., seemingly without cause, with similar disposition of the iritis to run its cycle. Atropin, dionin and heat locally seemed almost inert. At the end of ten days resorted to free continuous use of calomel and magnesium citrate, and in ten days the left eye was perfectly normal. This time and in each succeeding attack there were deposits on the posterior surface of the cornea. This attack was of three weeks' duration as against the six weeks of the second attack and the ten weeks of the first attack in which I saw him. Vision 5/4 in each eye.

September 22, 1902. Renewed outbreak, in right eye this time. The calomel and citrate was begun at once in spite of the entire absence of indican from the urine. This attack lasted four weeks, was highly plastic in character and was the most neuralgic he had had. There were vitreous opacities but no chorioiditis visible. Recovery with full vision of 5/4.

October 25, 1906. The right eye again showed signs of plastic uveitis. Vigorous calomel and celestine vichy with atropia 1/200 internally four times a day. Also nasal spray of cocaine and adrenalin. Rhinologist pronounced him entirely

free from nasal obstructive disease. Dionin used locally. Attack of two weeks' duration. Final vision was 5/4. No atropin used in the eye in this attack.

November 25, 1906. Refraction under thorough cycloplegia showed both eyes. +.50 sph. +.50 cyl. axis 180 degrees. Ordered +.50 cyl. axis 180 degrees, both eyes, to be worn constantly.

October 10, 1907. Left eye looks threatening. Influenzal attack four weeks ago. Wassermann test absolutely negative. No atropin locally but 1/200 four times daily internally, calomel and celestine vichy four times daily. No dionin locally. Vision fell to 5/12 during a mild attack of uveitis of 15 days' duration. Complete recovery with vision of 5/4.

January 9, 1908. A slight recurrence in left eye. No atropin in eye. Treatment entirely nasal and general as in preceding attack. Duration one week. Perfect recovery.

March 20, 1908. Another attack in right eye of one weeks' duration, yielding promptly to measures employed in October, 1907. Full recovery. Vision 5/4.

February 7, 1911. Tenth attack, also of one week's duration, almost without pain. Preceded by violent cold. Turbinates much tumefied. Advised to have them cauterized. Declined. Nasal spray, and calomel and vichy and atropin internally entirely controlled the attack, and vision which had fallen to 5/9 promptly returned to 5/4. It will be noted that in the last four attacks neither atropin nor dionin were used locally in the eye. Today, September 15, 1911, after ten attacks of uveitis anterior in fourteen years, the vision remains 5/4 full in each eye, the media are perfectly clear and the fundi normal. There is one small synechia in the left eye, directly down which has remained permanent since his second attack in 1897 and one rather broad one in the right eye, which has been permanent since the fifth attack in 1906. During the last three attacks he has lost but five days at his office and the condition no longer has any terrors for him. He has learned the value of intensive elimination and freedom from nasal obstruction and is at all times prepared to meet any oncoming symptoms.

*Remarks:* The case history just recited seems to me the most suggestive one of the series. The last four attacks were so quickly controlled by calomel and atropin internally and the nasal spray that according to the patient's statement they were hardly worth mentioning. It might be claimed that because

of their quick response to these measures, they were autotoxic in origin but the patient gave no evidence of autotoxemia and the urine was also negative, no indican being found in any of the late attacks. Syphilitic and tubercular they certainly were not and there is nothing to bolster up the belief that they may have been rheumatic.

Hiram Woods' study (Trans. Amer. Oph. Society, 1905) of nine cases of recurrent iritis indicated that in three cases gonorrhea was operative, and he feels that gonorrheal iritis would be more often diagnosed as such if more careful search were instituted. This I know was not causative in the preceding case. In three other cases, Wood found inflammatory rheumatism the exciting cause and in one other syphilis. He concludes that a constitutional dyscrasia is the underlying cause (rheumatism and gonorrhea being frequently in evidence) and that the exciting cause of a relapse is one or the other of numerous irritants, such as eyestrain from efforts to use an eye incapable of work from some other disease of refractive error, by pulling on some old synechia, exposure to wind, dust, etc. In the discussion of Wood's paper, Zeigler observed that he had been able to get many such cases under control by attention to their nasal conditions. He believes there is often an introduction of some material through the lymphatic chain causing these disturbances, and that nasal treatment has certainly often shortened the attacks and relieved the symptoms. Risley, too, thought that chorioidal and uveal disease should not be excluded as one of the associated disorders in sinusitis, and Edward Jackson looked upon nasal disorders as a rather common course of uveal trouble. Manning Fish's four cases of uveitis (*Amer. Jour. Ophth.*, Dec., 1904) that yielded promptly to intranasal treatment, are highly suggestive, and he accepts unconditionally Ziem's view that the passive orbital hyperemia causes venous intraocular stasis and an oedematous condition of the uveal tract. Fromaget and others abroad, and many American writers are of the same opinion, but all our views must remain purely a matter of opinion until the actual path of irritation or infection has been proven postmortem. Unfortunately this may be long deferred, as most of these milder infections recover and, even though the integrity of the eyeball is entirely destroyed, enucleation is so seldom done in these conditions that there is not much hope for such proof of what seems a justifiable assumption. It may be that laboratory experiment may finally



settle the question, but that, too, is conjectural. Meanwhile, clinical and laboratory study of these cases must be made as close as all modern methods will permit in the hope that final conclusions may be reached in that way.

To sum up we may say that—

1. The association of nasal and sinus disease with anterior uveitis, on the basis of clinical evidence thus far offered, seems altogether likely.

2. That constitutional dyscrasias may coexist and complicate our ideas as to etiology.

3. That syphilis, tuberculosis, gonorrhea, rheumatism and autotoxemia ought to be excluded by modern laboratory methods before sinusitis can be properly said to be causative.

4. That the most careful exploration of the upper tract should be resorted to in every case of uveitis.

5. That even in the presence of seemingly negative rhinologic conditions, intranasal and general measures that deplete the nasal mucosa to the fullest extent are to be recommended, as they certainly tend to shorten the duration of the uveal disease; and, when it has a tendency to become recurrent, may result in aborting subsequent attacks.

1212 Spruce Street, Philadelphia, Pa.

## DISCUSSION

DR. G. F. KEIPER, La Fayette, Ind.:—I want to congratulate the doctor on bringing this subject in this way before this section, emphasizing the connection between the nose and eye. Another factor to be considered, and Dr. Reber puts this largely on the lymphatic and blood supply, but there is also a nervous connection to be considered. For, if you will examine the anatomy of the nose and orbit you will note that the nasal nerve through the orbit very largely connects with the lenticular ganglion, which sends numerous branches to the eye. This balances up the nervous apparatus of the nose with regard to the eye.

I have had two cases of uveitis that have been benefited by the removal of the tip of the middle turbinate, which was pressing hard upon the septum. I have concluded that the result was obtained by taking the pressure off the nasal nerve and avoiding the reflex that will come through the lenticular ganglion.

DR. H. S. GRADLE, Chicago:—This paper of Dr. Reber's has particular interest in that the recent papers of Elschnig, which he did not write primarily on this subject, spoke of it in sympathetic ophthalmia, and he quoted statistics from his clinic and the Schnabel clinic. He gave 142 cases of iridocyclitis, 100 of spontaneous type. He called attention to the unknown etiology, because by the help of the different clinics he was able to eliminate all of the usual sources of uveitis, and in all these cases he found more or less deficient metabolism, as indicated by indican, etc. He also spoke of the close association of nasal trouble to uveitis,

though he did not lay so much stress on this as Dr. Reber has done. But Dr. Reber's paper will coincide with that of Elschnig in many particulars, especially as the "intensive elimination" is exactly what he has been driving at. These cases are not thoroughly unilateral as one might be led to believe. Of the 216 cases reported by Schnabel, forty-six were bilateral, while Elschnig's statistics showed 50 per cent bilaterality in 142 cases, and attributed to a form of auto-intoxication, particulars of which we know nothing about.

DR. S. D. RISLEY:—I am obliged to Dr. Reber for bringing so clearly before us this important subject. His presentation affords an excellent illustration of the great complexity which the etiology of many forms of disease present under our modern methods of research. His allusion to the valuable work of Elschnig on the auto-toxemias as an etiologic factor in the diseases of the mucous membranes lining the bony cavities in the anterior segment of the skull, is of signal importance. I believe it is quite as important indeed as in the affections of the uveal tract of the eye as urged in my paper yesterday in discussing the etiology of cataract.

There is another fact the importance of which I wish to emphasize; viz., the important relation which exists between congenital malformations in the anterior portion of the skull and disease, not only of the sinuses accessory to the nose, but to many affections of the eyes. We are all familiar, for example, with the great variation in the size and location of the sinuses contiguous to the orbits. This variation is usually associated with abnormalities in the form of the skull. Drainage, because of some abnormality in the nostril or in the situation of the drainage canal in one or more of the sinuses, is difficult or impossible and in consequence there is greater liability to disease; or, if disease of the lining membrane occurs from any cause in such cases, e. g., a common cold or from an auto-toxemia, recovery is more difficult and the affection becomes chronic. Then, too, the anatomical variations in the size and location of the sinus may affect the orbital walls in many conceivable ways and so lead to a greater probability of ocular participation in an existing sinus disease. Indeed Dr. Reber's paper affords a striking example of the frequency with which many forms of disease have congenital anatomical variations as an etiologic factor.

DR. H. B. YOUNG:—If Dr. Risley would add to his symptom complex the probability that the intestinal putrefaction was primary and the nasal affection secondary to that, he would be more nearly right.

DR. R. STAHL, Cincinnati, handed around some specimens of a stringy opacity in the vitreous.

DR. REBER (closing discussion):—The remarks made by Dr. Young will, I am sure, receive the endorsement of the Section. As to the nervous connection mentioned by Dr. Keiper, there can be no question. It is a large subject, being worked at now by Dr. John Green, Jr., and Dr. Greenfield Sluder. Dr. Bernstein, of Kalamazoo, wrote me a year ago, asking my opinion of the relation of nasal disease to the possible occurrence of interstitial keratitis, and I answered that I doubted the relation. The report I gave him at that time I should now have to modify. The unilateral cases are always under suspicion of being focal in origin. The bilateral cases are due to some systemic disorder. We are prone to decide that a case of uveitis is syphilitic, tubercular or rheumatic. If not, we put it down as obscure. My plea is for a closer

study of these cases. They should not be put down as tubercular until shown as such by our present methods; and they should not be put down as syphilitic without a laboratory verdict. I think that in the unilateral cases we will find out much in this way, and a good deal in the bilateral cases also.

Finally one word as to the use of the exophthalmometer of Hertel, of Vienna. It is so practical; it is so easy to put up and read off whether there *is* or *is not* any exophthalmus as to endear it to the heart of every practical worker. We have been in the habit of hurriedly studying a patient's profile and deciding whether there may be 3 to 5 mm. difference in the prominence of the two eyes, but with this instrument differences of 1 mm. are readily read off. In answer to numerous questions I would say that it may be had from Messrs. Bonschur & Holmes, Philadelphia, Pa.

## SOME SURGICAL PROCEDURES IN THE MANAGEMENT OF OLD TRACHOMA.

THOMAS FAITH, M.D.

CHICAGO, ILL.

When one considers the extreme uncertainty of success with the medical treatment of trachoma, and our inability, so far, to determine the exact cause of the disease (a fact which naturally prevents us from developing a scientific method of cure) one is justified in adopting any rational method which seems to give good results.

It would be folly for me to deny that many cases of trachoma have undoubtedly been cured by the application of caustics and astringents, and that almost all cases are temporarily benefited by such applications, but that there is a constant tendency to recurrence in most cases, even those that are apparently healed, and that the prognosis is correspondingly doubtful, cannot be disputed.

These facts led me a number of years ago to investigate and adopt the surgical measures which will be discussed in this paper, and my experience up to the present time further convinces me of the value of these methods. The methods which I refer to are not new, but I feel they merit your consideration, in view of the fact that they have not been generally adopted. They are: First, the excision of the tarsus with the overlying conjunctiva, as a radical cure for the disease, and, second, the early application of the Hotz entropion operation.

Excision or resection of the tarsal cartilage with its overlying conjunctiva is a perfectly safe and rational procedure, easy to do, and having few or no unpleasant sequelæ. It is indicated in all cases of chronic trachoma which have a history of recurrence, whether accompanied by pannus and corneal infiltration or not.

As previously stated, and as we all know, chronic trachoma is predisposed to recurrence, and as the disease is usually found in a class of foreigners who are hard to control, excision seems to me to be the rational procedure in the majority of cases, for the reason that each recurrence of the disease may do some permanent damage to the cornea; and it is particularly indicated

in cases in which the tarsus is undergoing cystic degeneration, or is deeply infiltrated and thickened. The operation is a painful one and, therefore, general anesthesia is preferable.

The technic I have followed is with a few exceptions the same as described by Dr. Casey Wood at a previous meeting of this Society, in this city, in 1903. (These Transactions, 1903.)

As most of our troubles with trachoma are in the upper lid, it is this structure which will need our attention. We proceed as follows:

The upper lid is everted and grasped with two fixation forceps

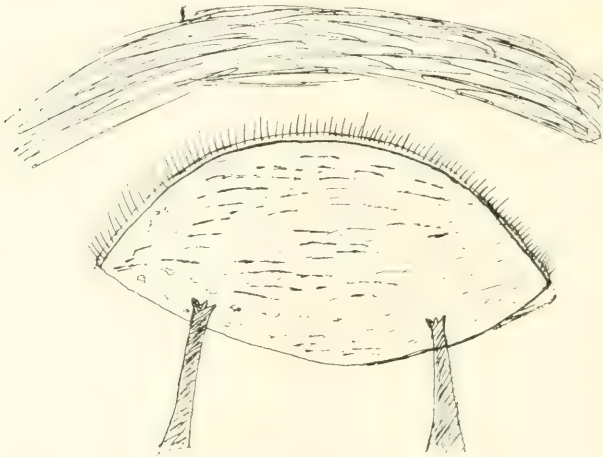


Fig. 1.

Showing forceps in position on everted lid, ready for second turn.

at and including the orbital border of the tarsus, the bite of the forceps is taken well into the outer and inner thirds of the lid, which is given another turn upon itself, and is then in position for the first incision, which is usually made just beyond the bite of the forceps, extending from the outer to the inner canthus and through the conjunctiva only. In this respect I believe I differ from Dr. Wood, in that he makes his first incision farther back in the fold.

I was led to making this incision as near as possible to the orbital border of the tarsus, after observing how loosely the mucous membrane was attached at this point, and how readily it gaped when incised.

The next step is the insertion of three double-armed sutures of about No. 3 twisted silk through the wound margin nearest the globe, placing them equidistant from the ends of the incision



and from one another, only penetrating the conjunctiva with one needle of each suture, and that as close to the wound margin as practical for a good hold. These sutures are now grasped with the left hand, holding them either with or without artery forceps, and, while the assistant still holds the two fixation forceps, keeping the lid in the original position, the operator makes slight traction of the sutures and with a sharp pair of Stephens' scissors undermines conjunctiva of the fornix, making the dissection extend down on to the globe for some distance. The sutures are now allowed to lie down over the face, resting on a sterile towel or operating cloth, and the forceps are removed.

Next, the lid is grasped at the center of its margin with a fixation forceps and a horn or metal spatula is placed against its skin surface; the lid is everted; and held in position with the forceps.

The second incision is now made parallel to the lid border, from two to four millimeters from its margin, extending the entire length of the lid and penetrating both conjunctiva and cartilage. This incision should meet the first incision at either end and when this has been accomplished the operator may grasp the tarsus and overlying conjunctiva with forceps and with scalpel or scissors, carefully dissect it from its attachment to the orbicularis, thus completing its excision.

The next step is the closing of the wound, and here again I depart from the technique followed by Wood. Each needle of the three double-armed sutures is passed through the entire thickness of the lid, from within out, being placed so as to coapt the tissues smoothly and draw the dissected conjunctiva of the fornix into close apposition with the marginal strip of conjunctiva and tarsus that has been left to retain the natural contour of the lid margin. With each of the sutures one needle should enter the tissues just above and the other just within this marginal strip, both needles emerging on the external surface of the lid about three or four millimeters apart.

When the sutures are placed properly, i. e., one in the center of the lid and one at either end of the lid about the center of the outer and inner thirds so as to avoid puckering of the conjunctiva, they should be tied over a small roll of gauze which is placed horizontally between the thread ends. After this the eye is flushed, the conjunctival sac and lids are well anointed with vaseline, and a dry gauze dressing is applied. The dress-

ing is changed once or twice a day, usually once, and on the fifth day the sutures are removed.

There are several important points which must be observed if the operation is to accomplish all that we wish. They are:

First: The first incision at or above the orbital border of the tarsus must pass through the conjunctiva only, for if it is made deeper Mueller's muscle may be injured.

Second: It is important to thoroughly undermine the upper margin of the wound, making a careful dissection, and thus

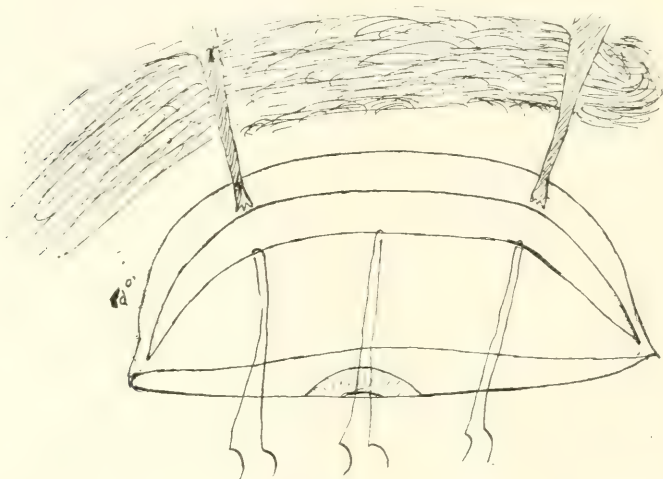


Fig. 2.

Showing first incision with wound gaping and sutures in position. The lid is everted upon itself, is turned twice.

emptying any follicles which may inhabit the subconjunctival tissue at this point.

Third: The incision at the lid margin must be a smooth and regular one.

Fourth: In dissecting the tarsus the scalpel or scissors must hug the cartilage in order to avoid injury to the orbicularis.

Fifth: The sutures must be accurately and carefully placed to get perfect coaptation and must not be drawn too tight.

As I have departed somewhat from the original method of doing this operation, I will give my reasons for so doing:

First: In the matter of the first incision, I believe much of the conjunctiva of the retrotarsal fold can be saved and at the same time the disease can be eradicated in this locality by a free dissection of the conjunctiva of the cul de sac, as, according to

Mayer, the follicles in this locality are principally subepithelial, and I have seen cases in which the follicles have immediately disappeared from this area after its dissection.

Second: In the placing of the sutures. Sutures tied so that their knots come on the inside of the lid are to be avoided, on account of the irritation of the cornea which they produce. Then, too, the lid must be everted in order to remove them, and this being difficult after the removal of the tarsus, may tear open the wound.

The method which I have described and have used for five or six years differs slightly from Blascovic's method, and has some advantages over the latter, I think. With it the cornea is not

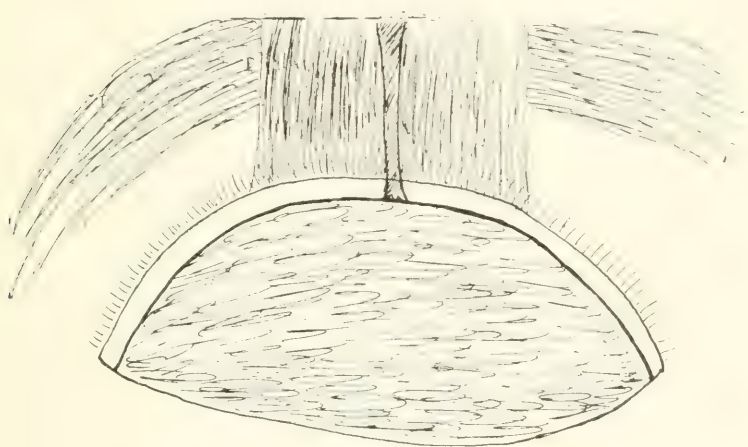


Fig. 3.  
Showing position of second incision.

endangered and the sutures are easily removed without everting the lid.

In my mind there are only a few contraindications for the operation; or, rather, for the time the operation should be done:

First: The operation should not be done until the conjunctiva begins to appear smooth along the lid margin, as this margin must be left in order to preserve the contour of the lid, and as it is to be left, the conjunctiva at this point should have passed through the florid stage before the operation is attempted.

Second: An eye should not be operated upon by this method when it is in an active state of inflammation, with free secretion, but should first be allowed to quiet down and the discharge become lessened or disappear.

Third: Any ulceration of the cornea, unless of a very superficial or marginal type, should be a cause for postponing the operation. Pannus is no contraindication, but rather an indication.

I have been doing this operation now about seven years and have only had two failures that I know of, and these were among my first cases.

In considering the Hotz entropion operation, it is not for the relief of the cases of typical entropion that I wish to discuss the method, as you all know of its value in that condition, but it is for the relief of those cases of trachoma that have passed into

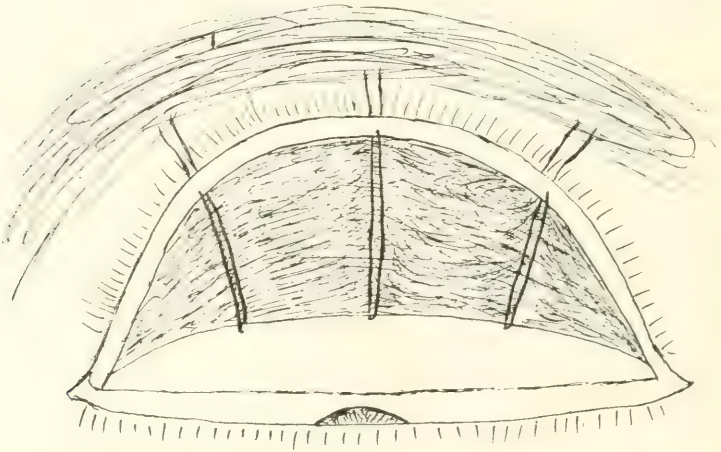


Fig. 4.  
Showing arrangement of sutures.

the stage of cicatrization, and whose conjunctivæ are practically smooth and free from inflammation, but who continue to complain of photophobia and other symptoms of corneal irritation. These cases frequently show a condition of old pannus which does not improve in proportion to the lid improvement.

If they are examined carefully, either one of three conditions will usually be found:

First: A tarsal cartilage which is thickened by infiltration or cystic degeneration, the weight of which keeps the cornea in a constant state of irritation. (These cases are ideal ones for tarsal excision.)

Second: A conjunctiva which is perfectly smooth except at or adjacent to the lid margin in the subtarsal sulcus, where there is a ridge of hypertrophied tissue called by Mayou, Arlt's

streak. The appearance which this ridge presents is sometimes like that of a string of closely strung flat beads. Bishop Harman thinks this appearance is due to the manner in which the conjunctiva is bound down to the denser tissue of the tarsal plate, there being present a marked degree of papillary exaggeration at this point. Collins and Mayou say that the formation and subsequent shrinking of this ridge is the principal cause of entropion.

Third: We may find that the subtarsal sulcus is shrunken and white; that instead of the ridge of hypertrophy there is a streak of connective tissue, giving this portion of the lid a



Fig. 5.

Vertical section through lid showing position of sutures.

cupped appearance, and that the border of the lid lies almost flat against the globe.

Both of these conditions are undoubtedly precursors of entropion, yet there is absolutely no inversion of the lashes in either condition. We may recognize either condition readily, and by operating early can prevent the irreparable damage which a true entropion will cause.

The latter mentioned condition was one of the indications for which Hotz himself frequently recommended and did the operation, often remarking that it was one of the positive indications for the operation that was seldom recognized early enough to prevent serious damage.

I will not bore you with a description of the Hotz operation, as you are all undoubtedly familiar with the technique. I sim-



ply wish to make a plea for its earlier performance, which will prevent the disagreeable effects of entropion and the permanent damage which it frequently does.

#### DISCUSSION.

DR. GEO. F. SUKER, Chicago:—This paper is of tremendous interest to all of us, from the very fact that most men have some hesitancy in sacrificing the tarsus, for the reason that they think it necessary for the maintenance of the contour of the lid and the position of the cilia. This is partially true only. As long as you leave the ciliary border of the tarsus, where, as a rule, you will not find any of the trachoma bodies, the lid will not evert or invert and you will not have ectropion or entropion. The tarsus itself is no protection to the eye, but under these conditions a menace, and the sooner removed the better it is for the eye. A large amount of pannus is prevented by the early excision of the tarsus, as described by the essayist. You will always have enough retrotarsal conjunctiva to pull down and cover the exposed portion of the lid, and restore a good, functioning lid without deformity. After excising the tissue I sacrifice, to some extent, the subconjunctival tissue between and make a deep dissection upward into the retrotarsal space to bring down the conjunctiva. The essential feature is the placing of the stitches. I have watched Dr. Faith's results for seven years, because enthusiastic along the same lines, and the results are good. However, I differ from him in that it makes no difference whether there is much discharge or not at the time of excision of the tarsus.

DR. W. B. VAN NOTE, Lima, Ohio:—I am only sorry that Dr. Faith did not have his paper yesterday before the ophthalmic section, for I believe this is an operation that the ophthalmologist should be familiar with. I think it is the best thing we have for treating old cases of trachoma in adults. In children the old roller forcep expression operation does very well. I do the operation very much as Dr. Faith does. Two years ago in New York I happened to be present at the Academy of Ophthalmology, where Dr. Woolton presented a series of cases operated on in 1909, and a number of the members thought the patient would not be able to close the eyelids on account of sacrificing so much of the conjunctiva. This proved incorrect. The after treatment was not mentioned. These cases have to be treated for a period of three to six weeks, in my experience at least, and I use a preparation that is simple, 1 to 500 bichloride to wipe the under surface of the lids, as a granulation surface springs up along the border where the stitches are tied. I tie them on the outside, as the doctor does. In cases of beginning pannus it does the most good, for the pannus clears up after the operation.

DR. THOS. FAITH (closing discussion):—If after a number of practical experiences these cases do all right and have no trouble with the lid, then the theory is right. The cases I advise this for are the old trachomas. I do not operate in the florid stage. But treatment should be used until the conjunctiva is in fairly good condition near the lid border before the operation is attempted. By following these rules I do not have to use after treatment.

## OPHTHALMIA AND TRACHOMA IN THE MOUNTAINS OF KENTUCKY.

J. A. STUCKY, M.D.

LEXINGTON, KY.

For more than a quarter of century so many of my patients coming from the interior of the mountain region of Kentucky had trachoma, that I determined I would personally visit this region to investigate the cause. In October, 1910, I visited Perry County, twenty-seven miles from the railroad, and in two days saw a hundred cases, five of whom had undergone trachoma; seven had follicular conjunctivitis. Three or four were absolutely involved in disease with vision correspondingly impaired.

In October, 1910, I opened my first clinic in Kinman, Knott County. I examined 200 cases, forty-eight with trachoma, many of whom were more pitiful and hopeless than I had ever seen.

I rode mule-back or in one of those springless wagons through the counties of Laurel, Perry, Knott and Breathitt, stopping at the mountain homes and school houses, to investigate as best I could the sanitary conditions of those homes, the methods of living and the conditions of the eye, ear and throat, especially in the children.

In these trips, not averaging more than three miles' travel, up hill, down hill, a narrow mountain trail just wide enough for a horse and rider to pass, with great danger after nightfall, and you are continually confronted with three things: First, the element of expectancy; second, the element of uncertainty, and, third, the element of danger, because some of it is risky. It is the result of this excursion that I desire to present to this Academy for discussion and advice. I have some accurate pictures of these cabin homes, the real things.

I will call your attention first to the simplicity of the natives of the mountains. They are ignorant; they are unlettered. They know nothing of hygiene, nothing of sanitation. Few of them can read. Race suicide is unknown. It is the rarest thing to find so small a family as eight children. In this twentieth century the average modern home here consists of the rudest kind of hut, about 14 by 15 or 16 feet, with no window. We are about forty-five miles from a railroad; no telephone, no tele-

graph station. No windows, a lean-to chimney, a little stove in that room and in this room live the parents and anywhere from seven to thirteen children. The average native is underfed from his appearance, insufficiently clothed and he does not use the water in the creek as often as he ought to.

I took one or two night rides; only that, as it satisfied me, especially on "Troublesome" and "Hell for Sartan." That is the name of a creek. When I tell you you can ride nine miles in four and a half hours and not see a sign of life after sunset, I am not stretching the truth a bit. The guide will take you up to a home and knock on the door; just before you get there you may see the faintest outline of a light through the cracks in the wall. It is rare to find a candle or a lamp, even one of those little dip lamps Noah brought in the ark.

These people all have a marked degree of asthenopia or weakened accommodation for near vision. Few of the cases even in the first or second stage yield to treatment unless with a plus lens. If my observations are correct, and I have forty-nine slides which representatives of the Russell Sage Foundation and the New York Board of Health will report on; we have been careful in making observations, and if these are correct, the conditions in the heart of the mountains of Kentucky are simply appalling. In my first clinic I saw a hundred people. They are suspicious and very ignorant. You have to be indorsed; they size you up, and they are for you to the last notch or they are "agin" you to the last notch.

To my first clinic one hundred people came in four days. A man would bring one child, blinking and leading him along. "How many in family?" "Nine." "How many have sore eyes?" "Seven." "Where are the others?" "At home." "Why didn't you bring them?" "I thought I would try you on this one first." Lids actually burned off. Could not see anything but a slit. Trichiasis, entropion, iritis, perforation of the cornea—great strong men, bigger and better looking than any man here, remind you of the pathetic Bible pictures you see with a little child leading the blind. One morning there were eleven women, seven of whom had nursing babies, sitting in front of the tent with a handkerchief over the eyes, reinforced by a big bandage, and the tears from these typical trachomatous eyes dripping down into the eyes of the babies.

At the second clinic I saw 210, at the third 88; all told 398. In the first clinic, out of the hundred I saw five typical cases

of trachoma in the second and third stages; four cases of the sequelæ of ophthalmia—tonsils, adenoids galore. They do not know anything about cooking; everything is fried; the bread is fried, pork, apples, potatoes and when they are not eating fried meats and fish out of the creek or suckers that come this time of year, they are sopping and soaking everything in sorgum molasses. Four cases of the sequelæ of ophthalmia, four cases of follicular or granular conjunctivitis.

In the second clinic of two hundred we found 48 stricken with trachoma. I saw nearly all these cases a second and third time and there was a marked improvement, but when they get a little better it is almost impossible to follow them up and treat them. In this clinic were 13 with follicular and granular conjunctivitis.

In the third clinic I found 58 with trachoma, at one place 17, at another place 9 and at another 7, making 91 cases of undoubted trachoma, with 47 cases of which I am not sure but having granular or follicular conjunctivitis. I have a long list of the cases of entropion, cicatricial tissue and a number of cases of trichiasis, a number of ulcerated cornea, a number of ground glass cornea, of pannus, etc.

It will perhaps interest you to know what I have been doing for these poor creatures. With many the first thing to do is to clean them up, then do a canthotomy and give them a little room. Turn the lid out as quickly as possible and then go after the cornea with the proper remedy; the silver preparation at first, then atropin until you get the effect and dionin frequently repeated, sometimes every two hours for 60 hours, adding a 25 per cent solution of freshly made argyrol to the eyes, closing it in. I have not had good results from expression unless I can keep them in the hospital. I have had better results by turning over the lids and going into the posterior part, and then with a probe wrapped in cotton and dipped in a 4 per cent of nitrate of silver, literally scrubbing off the trachomatous body. What has given me the most pleasing results after getting the operation started is one of the soluble citrates of copper.

It seems to me the solution of the problem is through the children. It is a question of education—a question of salvation. I should like to answer any questions. I could talk to you for an hour and not more than touch the subject. I should like some suggestions. As ozena is a reproach to rhinology, I believe the presence of trachoma is a reproach to oph-

thalmology. Why have we not found the specific germ? Is it a filth disease? Is it a disease of low vitality? I have seen school children there infected by a child coming from the mountains. There is so much about the disease I do not understand, so much that I expect from this, so much I am hoping for from the Russell Sage Foundation for the prevention of blindness, that I come from the old Kentucky home with a white flag. These counties are poor, only two having alms houses. I long ago learned that the best thing for the digestion of a man is the outside of a horse. When I started on the trips I had no idea of going more than 20 miles. I saw much that shocked me, and my mule back ride was extended to 226 miles. The diseased eye is not all of it. If I told you of the number of cases of low vitality, if I described the mountain fever; if I described some of the cases of facial paralysis, of the large cicatrices behind the ear where the mastoid has rotted out, I would be standing here all night. A fellow came in to see me, about thirteen years old, his face drawn around, red-headed and bare-footed, the pus running out of his ear. I said, "What's your name?" etc. "What's the matter?" He told me what was the matter. "How long been sick?" "How taken?" "I had a carbuncle." "What?" "Don't you know what that is? That is the festerinest riserin that ever was."

Dr. Young asked: Did you see anything in the investigation that would lead you to the belief that the origin of trachoma is not through the local contact but the bite of some of the fly family, particularly the common house fly?

Dr. Stucky: I believe it is transmitted directly. These cabins are dirty; they have not had a bath for months. I was surprised at the small number of flies I found in the mountains. My greatest surprise was so few birds, and the next was so few flies. As soon as the sun goes down these people go into the cabins and shut the door. They pile in three deep. I remember one night we were caught in the storm. There were seven in my party and nineteen in the house we stopped in, and the bunch of us stayed there. I stayed awake. They are the most hospitable people. Everybody wiped on the one towel. They will divide everything they have with you—towel or tooth brush. One of the most pathetic things is the condition of the mouth. They all need the dentist. The woman in the mountains is still not appreciated. If you look at these pictures you will see standing back in the shadow the woman. She not only bears



the heavy burdens of the rest but the heat of the day on the hillside. She gathers the grain, the wood. It is rare that she walks with her man, as they call the husband. She walks behind, generally with one child holding to each side of her apron, one or two behind and one in her arms.

#### DISCUSSION.

DR. F. PARK LEWIS, Buffalo:—It seems almost unnecessary to supplement what Dr. Stucky has so well and pathetically pointed out, but the situation is one of such serious importance that it certainly cannot be allowed to go by with simply a passing notice.

Two years ago word came to me that the mountains of Kentucky were the breeding places of trachoma. I stopped over in Lexington and Dr. Stucky took me to the hospital and showed me cases similar to those about which he has been talking today. Beautiful little girls and strong young men with pannused carnae; some of the men were splendid fellows. We do not appreciate what the mountains of Kentucky hold. I was told that there are a half million people in them and that the conditions which he had noted are in no wise exaggerated. They live in unlighted and unventilated huts, with insufficient and badly prepared foods. Tuberculosis is everywhere; gonorrhea is rife, and with all of these people mingling more or less, in gatherings which brings them across country for miles, we have a source of infection whose extent we cannot measure.

Dr. Wilder pointed out several years ago that it was southern Illinois that was furnishing the clinics of Chicago with the after effects of trachoma. It is very probable that from the foothills of these mountains infections are carried to the surrounding states. We have not begun to appreciate, I think, how much there is of this in the United States. Dr. Risley can tell us what is being done in Philadelphia, as there is an institute there for the treatment of trachoma. I understand that there is much of it in most of our large cities. Four years ago, when in Naples, I took occasion to look into the inspection of emigrants, as conducted there, and the larger meshes of the sieve hold out thousands, excluded for this cause. Several years ago Mr. Roosevelt said, in speaking of this subject, that trachoma was of great interest to him and it must be kept out of the United States. I do not believe a condition such as this described ought to be allowed to exist, and I hope some suggestion may be made by which the measures taken by Dr. Stucky and his assistants may be supplemented and the work enlarged. He has been very modest in describing his share of the work, as I know the tale has not half been told. He took with him four nurses and these worked day and night, and then just got on the edge of the whole infected tract. The mountains are full of it. What can we do about it? We should surely inaugurate measures for the protection of these people from themselves and of the whole country from the infection which they are spreading.

DR. S. D. RISLEY:—Dr. Stucky's too brief narrative has excited my compassion. I take it for granted that the needs of these poor people have been laid before the sanitary authorities of the state of Kentucky, but the story is new to me, and not only amazes me by its pathos, but

stagger me by its immensity. One man's work is utterly inadequate to meet so great a need for relief.

Dr. Stucky has said nothing about the treatment employed, but has asked for suggestions. It is probable that none of us can suggest anything by way of treatment or hygiene with which Dr. Stucky is not already familiar. It may be stated, however, by way of encouragement that my own experience with acute trachoma leads me to believe that our former judgments regarding the incurability and chronicity of the disease are no longer tenable. Experience of late years justifies the belief that both the chronicity and the unfortunate sequellæ of the disease were in large measure due to the frequent application of the crystal of sulphate of copper. It has not been employed at my clinic for twenty years. The method now pursued in acute cases is to carefully empty every trachoma granule with the roller forceps, which can be and should be done without tearing the conjunctiva, but the operation should be thorough, so that no granule is left to prove a source of reinfection. The patient is then placed in bed for twenty-four hours and iced compresses applied for a few hours; the conjunctival sac carefully irrigated with some mild alkaline antiseptic wash until all irritation has subsided. He is then allowed to return to his home with a wash of acetate of copper, as suggested by Dr. Prince. It is made in the following manner: He receives a 20 per cent solution of acetate of copper in glycerine, of which he places two drops in twenty drops of water and is directed to instill this in the eyes freely three times daily. He is well in a few weeks, and without the sequellæ so constantly observed in my earlier experience. When seen first in the later stages the same solution is useful, but no treatment can then in all cases prevent the cicatricies and resulting curvature of the tarsal cartilage. In cases where pannus is present I have found solution of tannin with iodine useful, of which relatively strong applications can be made to the inverted lids and retro-tarsal folds, or weaker solution can be instilled three times daily by the patient at home. I am opposed to the use of the colloidal silver salts for trachoma or any other form of mucous membrane disease. If silver salts are indicated the nitrate is to be preferred and the desired effect secured and regulated, either by the method of application or the strength of the solution employed.

DR. KEIPER, La Fayette, Ind.:—We are indeed under great obligations to Dr. Stucky for bringing this subject to our attention. I believe the pathetic side has so appealed to him that to sing "My Old Kentucky Home" must bring a pang of sadness to him.

I have with me a reprint of an article to which I must take serious dissent. I wish that its author were here. Its author is Dr. Aaron Bray, of Philadelphia, and is entitled "Are We in Danger of Trachoma?" If all its conclusions are to be accepted we are in very grave danger of an epidemic of trachoma in this country. This article was published in the New York Medical Journal, March 4, 1911, and hence has a wide and influential reading. His conclusions are as follows:

1. Trachoma is a disease not so contagious as it has been thought to be.
2. It is comparatively infrequent in Philadelphia.
3. Usually only mild cases come to our observation.
4. There is no trachoma problem in this country.
5. Trachoma does not thrive in civilized surroundings.
6. Trachoma is a curable disease.
7. Only neglected cases terminate in reduction of vision.

8. In this country it never leads to total blindness, except perhaps among the Indians.

9. Laws on this subject need not be oppressive.

10. Science makes no difference between employer and employe, between alien, naturalized and inborn citizens.

11. Trachoma is not on the increase, but rather on the decrease.

12. A trachoma institute, for the purpose of investigating the various aspects of this disease, already exists in Philadelphia.

13. And finally to create fear among lay people as to the existence of imminent danger resulting from trachoma, which is purely imaginary, is entirely unscientific and harmful to the best interests of the community.

When I read this paper my indignation arose within me and it has not abated in the least with the lapse of time, for I have been through two epidemics of trachoma. Both were in institutions for the care of orphan children. In the one we had over two hundred cases traceable to one boy who had entered with trachoma. It took us two years to eradicate the disease. In the other, one boy inoculated forty others.

Now let us become careless by observing the conclusions of this paper, and I predict that we will see a rapid increase of trachoma in this country. By all means let us go back to our respective communities firmly resolved to so instruct our people that we are always in grave danger from trachoma and that we ought to exercise due vigilance in stamping it out if possible.

I regret to disagree with my esteemed friend Dr. Risley as to the contents of Prince's prescription for trachoma. It is a 10 per cent solution of *sulphate of copper* in glycerine instead of the acetate of copper. The patient is to take one drop of the medicine and put it in twenty drops of clean water and use the mixture freely in both eyes. This is to be repeated every four hours. The strength of the mixture is to be increased until one drop of the prescription is used in ten drops of water. It must be made fresh each time. I have used it ever since Prince announced it and consider it a valuable addition to our therapy for trachoma.

DR. GOULD: With regard to the copper, the sulphate solution, it might be interesting to know how it happened to be discovered. I remember it, and it made an impression. Dr. Prince had a case of trachoma and he was not satisfied with the treatment; neither was the patient, but he came back after a while showing pronounced improvement and Dr. Prince wanted to know how that was accomplished. The patient informed him that a woman, not a physician, had recommended a solution to him, and Prince got the drug from him and had it examined and found it was copper sulphate in glycerine.

DR. W. C. WILLIAMS, Peoria, Ill.:—So long as we have reverted to copper sulphate, another important point of Dr. Prince's is that it rapidly decomposes after the glycerine has been added to the water, and must be made fresh each time. Perhaps it dehydrates the copper sulphate. I have used it ever since Prince wrote about it, about two years, and patients take to it kindly, but you have to graduate the strength to the patient. It may be thirty drops of water to a drop of the solution, and it may be ten. Different patients show different susceptibility.

DR. JULIUS STOLL, Cincinnati:—I have listened to Dr. Stucky's paper with the greatest interest. His vivid and fascinating description is sufficient proof for his urgent plea. To illustrate how dangerous such a focus might become, I should like to mention a case which came under

my observation last summer. A young lady of Cincinnati had accepted a position as a teacher of the Indian school at Rainy Mount, near Cotebo, Oklahoma, where trachoma is endemic and an actual menace, so that the government had to send physicians and nurses to that reservation. My patient contracted the disease there and returned home for treatment. Had she not been acquainted with the contagious properties of trachoma, she might have become a medium of carrying it over a great distance and incidentally spreading it in the railroad. You have seen passengers dry their faces and eyes on the roller towels hung up in the day coaches. A person from these mountains, if on a visit to any city, might unawares bring trachoma to the tenements, the inhabitants of which are only too liable to become infected with it. We must sincerely regret that Dr. Stucky is hampered in bringing this condition before the eyes of the general public; however, his ever active mind will undoubtedly find a way to enlighten the inhabitants of his mountains.

## ON THE USE OF RADIUM IN OPHTHALMOLOGY.

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It may be of interest to consider for a few moments the physiological action of radium on the eye and I therefore invite your attention to some of the results of the observations of E. S. London, Greef, Hardy and Anderson.

If one brings radium, in sufficient quantity, in contact with the closed eye in a dark room the patient experiences a sensation of light. This can be produced by laying the radium on the temple or on the vault of the skull and occasionally also, when it is applied, to the occiput. The phenomenon is probably produced by the irritation of the cortical visual center. Blind persons who have not lost the perception of light experience the sensation of light as well as those who see. E. S. London<sup>1</sup> states that owing to the power possessed by radium of producing on a fluorescent screen bright lines and figures, it was possible in the case of a man suffering from partial optic atrophy, to enable him to see to read and write by the "silhouette" method.

Investigations have been made with the view of finding out whether the radium rays had a specific action on the eye through the nervous elements, through the media or through the optic nerve. Greef<sup>2</sup> who has studied this subject closely has come to the conclusion that the radium rays act neither directly on the retina nor upon the visual purple.

He is also of the opinion that in consequence of the lack of refractive power of the rays, no picture can be thrown on the retina. The sensation experienced, therefore, is produced by fluorescence of the ocular media.

Hardy and Anderson<sup>3</sup> submitted the retina of a freshly killed frog for 20 hours to 50 mg of radium bromide at a distance of 3 mm. They discovered that the exposed retina did not differ from that of the control eye, either in relation to the visual purple or in any other respect. Hence the radium rays have no direct influence on the retina. The most active agents in producing the fluorescence are the Beta rays, as is proved by

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<sup>1</sup>E. S. London, *Das Radium in der Biologie und Medizin*, Leipzig, 1911.

<sup>2</sup>Greef Prof., *Deutsch. Med. Woch.*, 1904, p. 452.

<sup>3</sup>Hardy and Anderson, *Proc. Roy. Soc.*, 1903, Vol. 72.



the refraction of these rays by a magnet when the light phenomena markedly decrease. The Beta rays do not reach the retina being absorbed by the cornea, lens, and vitreous. These media correspond to the skin layer of 6.6 mm. in thickness.

The time allotted for this paper will not permit me to trace the course of experimentation by various observers in relation to this subject but the following conclusions have been reached:

The radium rays produce a visual sensation which is probably a fluorescence of the refractive media and possibly of the retina itself. On the other hand, it is in part due to the direct irritation of the cortical visual center producing an increase of visual power. In consequence of the material nature (being composed of particles) and of their irrefragibility, it is not possible for the radium rays to form an image on the retina.

We owe the introduction of radium in the treatment of eye diseases to Dr. Mackenzie Davidson<sup>4</sup> in London, Professor Bayet in Brussels and Drs. Octave Claude and Darier, in Paris. Dr. Davidson said at the meeting of the British Medical Association in London in July, 1910: "But, if radium has not so far fulfilled all the hopes which were entertained of it, it has, at any rate, accomplished something, and it is encouraging to turn for a moment to a new field of experiment in which it has yielded good and definite results; namely, in certain diseases of the eye."

The diseases of the eye to which radium can be successfully applied are external—the eyelids, cornea and conjunctiva. It has been tried in chronic glaucoma, but the results were not such as to encourage the observers to persevere with the treatment.

Before passing to treatment of certain eye diseases, I would like to say a few words about the methods of application.

Radium has been applied either directly to the eye "naked," as it is called, or by some method of filtration. In applying it "naked" the powerful caustic effect should be borne in mind, and also that the ill effects only manifest themselves after an interval of two weeks or more, when serious sloughing may take place. In my opinion, in all cases, except epithelioma, the rays should be filtered through lead, tin or aluminum. The eye should be cocainized, the apparatus being held in contact for ten or fifteen minutes and not more. The application may be repeated daily. The applicator should contain four milligrammes of pure

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<sup>4</sup>Mackenzie Davidson, introductory address, section of radiology, British Medical Association, July, 1910.

radium, mixed with bromide of barium, and spread on the flat surface, and covered with waterproof varnish. In ulcers of the cornea I have found the round applicator of much use. It is primarily intended for nose and throat work, and contains three milligrammes of radium bromide. When a tube is used it should be covered with lead foil and thin rubber tissue. For external application, a disk or square is used of various sizes. The square contains four milligrammes of radium bromide, diluted with barium bromide, and covered with impermeable varnish. When applied to the lids for epithelioma or rodent ulcer the applications should be of one hour each, and the alpha rays should be screened off with lead filters. I have seen no ill effects from its use, but several times patients have said that they saw sparks.

Some patients complain of a little pain after its use, and in almost all there is increased vascularity and irritability for a time. The anesthetic effect is generally noticeable, the application being followed by a relief of pain.

*Eyelids.*—The diseases for which I have used radium or have seen it used on this part have been rodent ulcers, angiomas and epitheliomas.

The following is a short history of one of these cases: A gentleman, aged 60, was referred to me by Dr. Langstaff of Richmond Hill. He had a large rodent ulcer of twelve years' duration, occupying the inner angle of the left eye, the eyelids and extending down the nose for about two inches. There is almost complete destruction of the lachrymal sac. This gentleman has had forty-four hours of treatment, extending over three months, half an hour to one hour, at intervals of a week or two weeks, with the result that the part is covered for the most part with a smooth, fine scar. There is still a little ulceration of the lower part of the nose, but it is healing rapidly. I saw at the Institute of Radium and at Dr. Massoitti's clinic in Paris several cases of epithelioma of the lids, in one of which there had been a return to a slight extent after a period of three years.

R. Abbe<sup>5</sup> records the following remarkable case of sarcoma of the eyelid:

"A man of 45 years had a growth for a year so as to involve two-thirds of the lid. It grew equally on the mucous membrane, on the eye and on the skin, so as to form a mass in which

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<sup>5</sup>R. Abbe, Archives of the Roentgen Ray, London, Feb., 1910.

all semblance of the lid and lashes was lost. It resisted Roentgen ray application and all other treatment by ophthalmologists. A section was taken from its center and showed small cell sarcoma. The patient was offered to me to try radium before excision of the lid. I laid strong radium in glass tubes upon it four times during one week, protecting the eyeball by a thin lead shield. Then I waited. Week by week it melted away. In eight weeks it was absolutely gone. Five years have gone by, and not a trace of it has recurred. Nothing so nearly resembling the marvelous has ever been my fortune in surgical work.

*Eye-brow.*—The following case of sarcoma of the eyebrow is an example of the rapid disappearance of sarcoma under the influence of radium. A lady, aged 69, was referred to me by Dr. Perfect of West Toronto on September 26, 1910. She had a tumor in the right eyebrow about the supraorbital notch, measuring  $2\frac{1}{2}$  cm. by  $1\frac{1}{2}$  cm. oval in form, firm and elastic to the touch. Dr. Perfect informed me that he had removed the growth three weeks previously and had submitted it to Dr. Archibald for examination, who had reported that it was a small celled sarcoma. Within three weeks it had recurred larger than ever, and was growing rapidly. I applied a plaque of 4 milligrammes of radium for one hour daily for eleven days, when the tumor gradually disappeared, and has not up to the present writing shown any signs of returning. To render the cure permanent, she has had two further treatments of one hour each, at intervals of four weeks. At the present time, one year later, there is no sign of recurrence.

*Conjunctiva, Trachoma.*—This intractable disease seems to give very encouraging results with the radium treatment in the hands of Mackenzie, Davidson, Darier, Lawson, Selenowski and others. Let me quote Selenowski's observations.<sup>6</sup> He treated twenty-three patients (forty-four eyes). In nearly all of the cases the upper and lower lids showed formation of granules, with diffuse infiltration. He first employed 1 milligramme and later 1 centigramme of radium bromide. After two or three sittings the granules became flattened, but the epithelium remained intact. In the following sittings the number of granules diminished considerably. The treatment was continued until the conjunctiva became perfectly smooth. Every eye was exposed to the influence of radium from 15 to 100 minutes. In no case were any scars seen; in some cases there

<sup>6</sup>Selenowsky, Wiener Med. Presse, Sept. 2, 1906.

was hyperemia. The deeper parts of the eye showed no reaction whatever. No other remedies were used during the treatment. Dinger<sup>7</sup> of Amsterdam treated sixteen cases; of them seven were cured. Old cases complicated with pannus yielded slowly, but the granulations and pannus gradually disappeared and the patients were able to resume work. The cure was more rapid and less painful, and therefore preferable to caustics.

Pterygium has been treated with radium. The results hitherto obtained are encouraging: about one-half the cases were cured.

*Spring Catarrh.*—This is notoriously one of the diseases of the eye which has resisted all treatment. Here and there a good result has been obtained by diverse methods, but nothing certain has been accomplished, until the advent of the radium treatment. Dawson Turner<sup>8</sup> publishes five successful cases, the first of which was cured five years ago, and there has been no return. Let me cite one of them: It is that of a boy, aged 6, both of whose lids were covered with typical granulations and irregular pavement-like blocks. The disease has lasted for some months. Ten milligrammes of pure radium bromide were used for ten minutes daily. Three or four weeks elapsed before any marked improvement appeared; then it was slow and steady. In two months, the treated eye showed great improvement, only one nodule being left, and in six weeks longer was entirely well, when the treatment of the other eye was begun. Mackenzie Davidson also reports successful cases.

*Lupus of the Conjunctiva.*—Wickham and Degrais<sup>9</sup> report the successful treatment of a case of lupus of the conjunctiva. The history of this case is as follows: A young woman in the service of Dr. de Beurman was treated for a lupus of the palpebral conjunctiva of both the upper and lower lids. One-half hour of application of radium sufficed to effect a cure. An apparatus containing 6 milligrammes of pure radium covered with rubber tissue, was applied for ten minutes at a time for three days in succession on three places on the upper lid and two places on the lower one. It produced a slight inflammatory reaction followed by sedation and reduction of swelling and redness. Three weeks later a second series of applications were made similar to the first. The cure which was obtained has continued for three years.

<sup>7</sup>Dinger, Berlin, *Klinische Wochenschrift*, 1906, No. 40.

<sup>8</sup>Dawson Turner, *Radium*, Bailliere, Tyndall and Cox, London, 1910.

<sup>9</sup>*Radiumtherapie*, Wickham et Degrais, 2nd edition, Paris, 1912.

*Cornea*.—Lawson and Davidson<sup>10</sup> publish seventeen cases of corneal ulceration treated by radium, sixteen of which were cured. Three were hypopyon ulcers, one a dendritic ulcer, four vascular, two herpetic, one Moorens and two traumatic. The failure was in case of deeply infiltrating yellow ulcer, complicated with inflammation of the lids. They report seven cases of interstitial keratitis, five improved, two doubtful. Four cases of opacities of the cornea, results uncertain. They say: "It is certain that if any success is to follow the treatment of corneal scars by radium, the exposures must be continued over a long period of time and the dosage must be fairly large."

I have treated three cases of corneal ulcer with marked success—one a recurrent vascular ulcer, one extensive sloughing indolent ulcer and one infiltrating deep ulcer, which had resisted all other means of treatment.

*Iris*.—I have recently read of the successful treatment of tuberculosis of the iris, but I am unable to locate the article and give my authority for the statement. The treatment consisted in the injection of radium emanation into the anterior chamber.

*Uveitis*.—C. H. Williams states that he had been able to relieve pain and cause the absorption of inflammatory products in chronic uveitis.<sup>11</sup>

Darier<sup>12</sup> first remarked the analgesic action of radium on the eye, and described a series of cases in which, through radium therapy, he was able to relieve severe pain in supraorbital neuralgia, in pain from epithelioma of the orbit, iridocyclitis and gouty pains in the eye.

*Fundus*.—It seems to me that there are two classes of cases with which no one has as yet experimented, and which resist all known means of cure. I mean opacities of the lens and of the vitreous. There is a form of lenticular opacity which is characterized by minute opacities, which remain stationary over a very long period of time.

I think I have said enough to show that in radium we have a powerful new aid to the therapeutics of the eye. In the cases of rodent ulcer and epithelioma of the lids, angioma, trachoma, spring catarrh and in certain ulcers of the cornea we can safely say that definite results have been obtained.

<sup>10</sup>Arnold Lawson and Mackenzie Davidson, B. M. Journal, Nov. 12, 1910.

<sup>11</sup>C. H. Williams, De Schweinitz, Diseases of the Eye, Philadelphia, 1910.

<sup>12</sup>A. Darier, La Semaine Medicale, 1903, No. 40.



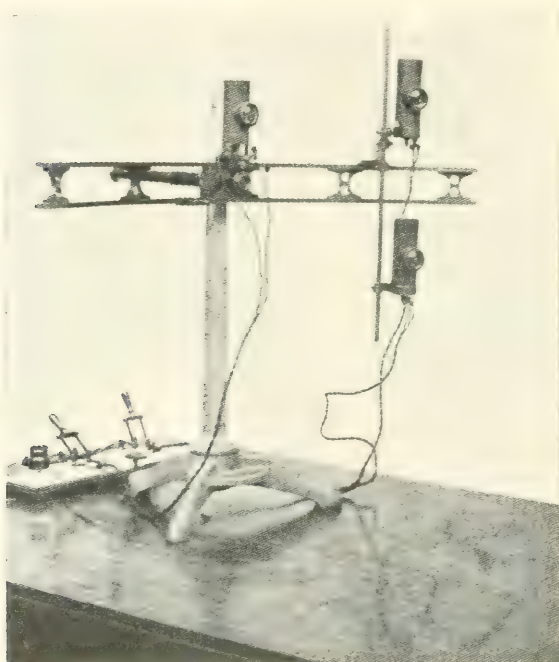
In conclusion I can say, without exaggeration, that radium has made good. As is the case with all new methods of treatment, too much has been expected of it, and the impossible has been attempted. True carcinoma is still outside the possibilities of cure, while sarcoma if superficially situated and of recent growth will rapidly melt away.

## TSCHERNING'S PHACOMETER.

LUCIEN HOWE, M.D.

BUFFALO, N. Y.

"The base of the ophthalmophacometer is a heavy tripod supporting a pillar of iron about fifty centimeters high. On the top a telescope is firmly fixed, which has a focal distance of about eighty-five centimeters. The telescope as described by Tscherning



has a magnifying power of about twelve diameters, but it gives an inverted image. This inversion is very confusing, however, and requires the observer to make a mental transposition of the images in order to understand their relative positions. Consequently after some trials I adjusted to the tube an erecting eyepiece, which decidedly simplifies the examinations. The axis of the telescope forms one of the radii of a brass arc, whose concavity is directed forward, the arc having a radius of about eighty-five centimeters. The object of this long radius is to

place the telescope so far from the observed eye that it is possible to focus at the same time the reflections from the cornea, from the posterior, and also the one from the anterior surface of the lens. This arc is so attached as to revolve about the axis of the telescope, and the degrees are numbered from zero in the center to about thirty on either side. On this brass arc three "cursors" or "carriers" are fitted to move from side to side as desired.

These are :

Carrier A, which bears one electric light.

Carrier B, which bears an upright bar on which there are two lights.

Carrier C, which bears an upright bar on which there is a small ball or bright button at which the patient is to look. If any one of the different lamps be lighted (that on carrier A, for example) and brought near the center of the arc, we see through the telescope the three reflections already described. The one from the surface of the cornea is well defined and the brightest of the three; the reflection from the anterior surface of the lens is blurred, dull and can be distinguished with difficulty; and, finally, the reflection from the posterior surface of the lens is small, bright and easily seen. When carrier B, which bears the two lights can be brought into alignment with the one light of carrier A, and the visual axis directed towards the point of fixation of carrier C, then with the aid of certain simple formulas it is possible to measure the exact position of the lens, and the changes which its two surfaces undergo during the act of accommodation.

## ANESTHETICS DURING OPERATION WITHIN THE MOUTH.

SAMUEL IGLAUER, B.S., M.D.  
CINCINNATI, OHIO.

The "split" mask shown in the accompanying illustration is designed for the purpose of continuing the administration of the



Split Mask. P. P., Pivots. R. R., wire rim to hold gauze in place. B. B., transverse bars over which gauze is folded. Mouth-gag in place.

anesthetic, while an operation is being performed within the oral cavity. In all respects it resembles an ordinary chloroform inhaler, except that two transverse bars (B.B.) are pivoted in the rim at P. P., in such a manner that the mask may be thrown open in its transverse diameter as shown in the photograph.

The mask is used in the following manner: Sterile gauze in two sections is folded over the transverse bars B. B. and is held in position by the wire rim R. R. The anesthetic is first dropped upon the closed mask until the anesthesia is complete.

The two sections of the inhaler are then separated (see cut), leaving an opening corresponding to the mouth, which is held open by a mouth gag. The surgeon then proceeds to operate *through* the mask, while the anesthetist continues to drop the anesthetic upon the two sections of the "split" mask. The anesthetic vapor being heavier than air tends to gravitate into the mouth and the anesthesia may be prolonged for a considerable period without interrupting the operation.

The mask interferes but very slightly with the necessary manipulations of the operator and the inhaler does away with the necessity of complicated pumps, vaporizers, etc.

The mask may be procured from the Western Surgical Supply Company of Cincinnati.



## TONSIL INSTRUMENTS.

RICHARD J. TIVNEN, M.D.

CHICAGO.

### TONSIL HEMOSTAT.

During a tonsil operation it frequently occurs that after one tonsil has been removed a considerable period of waiting is necessary to control the resulting hemorrhage before the operator obtains a clear operative field and may, without annoyance from the hemorrhage, proceed to the removal of the remaining tonsil. In such cases my tonsil hemostat (Fig 1) has proved efficient.

It arrests the hemorrhage promptly, eliminates the delay usually incident to its control, secures a clear operative field and thereby shortens the period of anesthesia, the time of operation and minimizes greatly the danger of subsequent hemorrhage. The special application of this hemostat is for the control of hemorrhage *during* the operation. It may be used, however, equally well for post-operative tonsillar hemorrhage.

Its application is expeditious and simple; it can be used for either tonsil without change or adjustment; and being constructed entirely of metal, may be boiled without injury.

The clamping arms of the instrument are thin, light in weight, and when in position, the inner arm and pressure bulb adapt themselves snugly to the tonsillar fossa and anterior pillar; beyond the pillar, the arm is so curved as to rest between the alveolar process and the cheek; while the portion of arm and lock protruding from the mouth is short, curved abruptly to the other side, and entirely out of the way of the operator.

The field of operation is not in the least obstructed by its use and neither the subsequent introduction and manipulation of the necessary instruments for the removal of the remaining tonsil nor the technique of the operator need be curtailed, modified or embarrassed by its presence.

In using the instrument, I have found it of advantage to cover the oval bulb with three or four layers of sterile gauze, the ends of which are first trimmed short so they will not project into the operative field, then gathered together and secured just over the base of the bulb by an ordinary rubber band, previously

sterilized. This covering is moistened with a (1 to 1,000) solution of epinephrin (adrenalin chlorid).

A pad of gauze is also placed just behind the angle of the jaw to protect it from the slight amount of pressure exerted at this point by the external counter device of the instrument.

Summarized, the advantages of the instrument are:

1. It arrests tonsillar hemorrhage promptly and is available for either operative or post-operative hemorrhage.
2. It can be quickly applied to either tonsil, without change

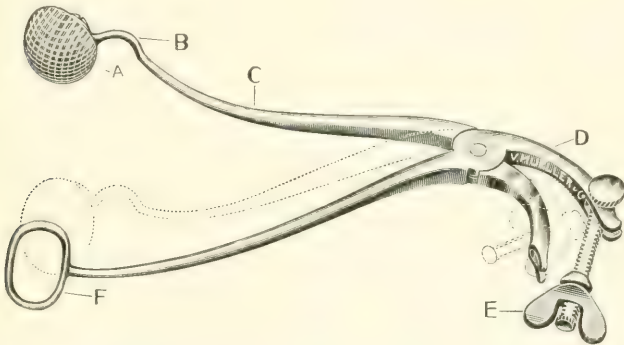


Fig. 1. A, Serrated aluminum tonsil pressure bulb, oval in form to conform to the tonsillar fossa. B, Curve, which overrides the anterior pillar. C, Arm, curved to rest, external to the teeth, between the alveolar process and the cheek. D, Portion projecting from the mouth. E, Thumb-screw and swinging arm lock for securing instrument when closed and applied. F, The external fenestrated counterpressure plate. The unbroken heavy lines indicate instrument when open. The dotted lines indicate its appearance when closed.

or adjustment, and when in use does not in the least obstruct the operative field.

3. It is simple in construction, light in weight and being entirely of metal, may be sterilized by boiling with injury.

4. The amount of pressure necessary to exert in controlling the hemorrhage is slight, and when the pressure applied is judiciously graduated and not necessarily prolonged, the tissues are not traumatized and the patient is not subjected to additional hazard by its use.

5. By securing a clear operative field, it conduces materially to the carrying out of a satisfactory technique and surgical thoroughness, shortens the anesthesia and operative period, eliminates the hazard and annoyance of operative hemorrhage and minimizes the danger of subsequent hemorrhage.

## TONSIL SPONGE FORCEPS.

A satisfactory tonsil sponge forceps should be light in weight, simple in design, easily operated, carry securely a sponge of sufficient size and form to serve its purpose adequately and so constructed as to adapt itself readily to the oral cavity and tonsillar region.

This tonsil sponge forceps (Fig. 2) was designed to meet these requirements.

The instrument is provided with a lock to hold the sponge securely; the sponge receptacle is cup-shaped, oval in form to correspond to the general contour of the tonsil and tonsillar fossa; the "cup" in which the sponge rests is sufficiently large to accommodate a sponge of proper size; the edge or flange of

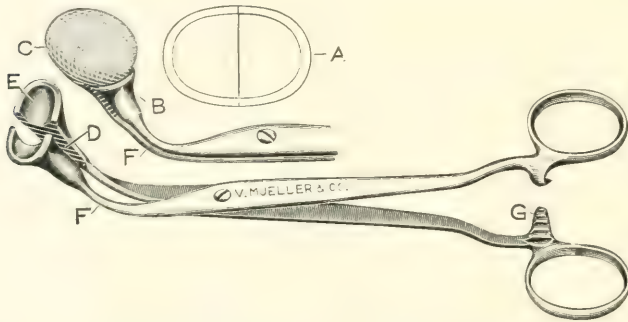


Fig. 2. A, Outline of sponge cup. B, Base of sponge cup. C, Sponge in position. D, Instrument opened to show serrated portion at inner side of cup base for retaining ends of sponge. E, Receptacle for sponge. F, Showing angle of sponge cup to the handle. G, Lock.

the cup is overlapped by the sponge, thus presenting a smooth, cushioned surface, which minimizes the trauma to the tissues to which it is applied and in addition provides an even, firm resistance of a solid oval sponge-body, which exerts firm and evenly distributed pressure throughout every area with which it comes in contact.

The two halves of the sponge cup are serrated at their base to engage firmly the base of the sponge, which is inserted between them; the cup itself is placed at a slight angle to the carrying arm of the instrument to permit the operator an unobstructed view of the tonsillar area when applied and to promote facility of application to the depths of the tonsillar fossa. The sponges for the instrument are prepared by taking a small square of gauze, filling with cotton to the required size and

then gathering the ends of the gauze together over the cotton filling, much as a pouch is made.

The gathered ends of the gauze are twisted together and are then easily inserted between the open halves of the cup, which is closed and locked. Before operation, a sufficient number of such sponges are thus prepared and sterilized. From four to six sponge forceps should be at hand for the operation, and during the operation the assistant is entrusted with the arming and disarming of the instrument.

#### TONSIL GRASPING FORCEPS.

The advantages of this instrument (Fig. 3) are:

1. It is thin, light in weight and delicate in construction,

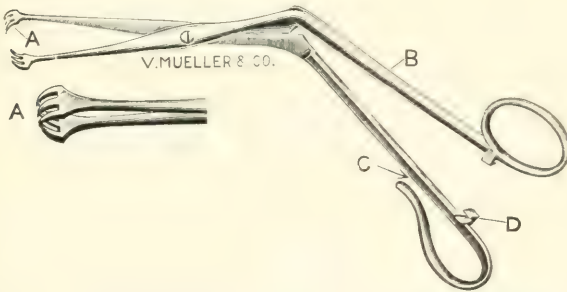


Fig. 3. A, Tonsil grasping portion. B, Showing angle of handle to grasping arm. C, Opening in finger ring for introduction of snare. D, Lock.

thus permitting facility of operation and an unobstructed view of the tonsil and tonsil area.

2. The grasping portion is curved to adapt itself to the tonsil contour; the teeth, three in number, are edged, curved, spaced and approximate snugly to engage the tonsils easily and securely. This arrangement is of especial advantage in dealing with the so-called "submerged" variety of tonsil.

3. The handle of the instrument, being nearly at right angles to the grasping portion, the hand of the operator is situated out of the line of vision and thus prevents an unobstructed view of the field of operation at all times.

4. When the tonsil is once engaged the instrument is locked, and the tonsil remains secured until removed.

5. The snare is applied without releasing the tonsil, by entering the loop at the opening in the finger ring, sliding it over the instrument down to and over the tonsil.

## TONSIL PILLAR SEPARATOR.

The advantages of this instrument (Fig. 4) are:

1. It is of sufficient weight to impart a comfortable sense of security and balance to the operator's hand.
2. The length of the handle enables the operator to perform the necessary manipulations without obstructing the view.
3. The handle is round to permit rotation of the instrument and is serrated throughout so that it may be held firmly and securely.
4. The blade is placed almost at right angles to the handle; it is slightly oval from side to side, to conform to the tonsil

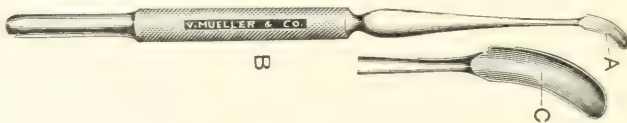


Fig. 4. A, Cutting edge of blade. B, Handle. C, Showing oval form of blade, from side to side.

contour and thinned and rounded at the point; and the cutting edge may be made sharp or dull.

## ADENOID HEMOSTAT.

The amount of blood lost in the removal of adenoids is usually considerable.

While the hemorrhage is not ordinarily considered of serious moment, occasionally, however, it is accompanied or followed by serious consequences to the patient. It is therefore the manifest duty of the operator to safeguard his patient in every possible way and to eliminate every factor which may endanger the patient's life or prolong his period of invalidism.

Viewed from this standpoint, the control of hemorrhage incident to the adenoid operation becomes a matter of importance and merits thoughtful consideration.

The adenoid hemostat is designed for the control of hemorrhage during or following adenoid operation.

In design and construction this instrument differs in only one essential particular from the tonsil sponge forceps already described (Fig. 2). In the adenoid hemostat the sponge cup is placed at nearly right angles to the carrying arm in order to accommodate itself easily to the naso-pharynx, the angle of the sponge cup to the handle, marked F in Fig. 2, approaching more nearly a right angle in the adenoid hemostat.



The sponge used is previously prepared and its size is regulated from an estimate of the size of the patient's naso-pharyngeal space.

After removal of the adenoid, the sponge is moistened in epinephrin (adrenalin chlorid) solution (1 to 1000) and is quickly but gently applied to the naso-pharynx, being introduced in the same manner as the adenoid curet. It is then firmly pressed against the vault of the pharynx and retained in this position until the hemorrhage has ceased and is then slowly and gently withdrawn.

32 North State Street.

## PRESENTATION OF NASAL INSTRUMENTS.

EDWIN PYNCHON, M.D.

CHICAGO.

1. In order to facilitate the early introduction of any of the usually employed punches for the removal of the anterior wall of the sphenoid sinus, the herewith shown knife is of value for making a preliminary enlargement of the closed osteum. After the anterior half or two-thirds of the middle turbinal has been removed, whereby the osteum is brought in view, the knife point is entered in the osteum and two downward cuts made



Fig. 1.

so there will be formed a loosened triangle of the bone, which is thin at this point. After this is done the punch required is easily entered.

2. After the middle turbinotomy operation, as usually performed, it is at times desirable to curette some of the ethmoid cells. Curettes as heretofore made have been usually too large.



Fig. 2.

The one herewith shown is of small size and will therefore more easily break through the bony cells, and with the employment of less force by the operator. With too large a curette, and through the much greater force required in its advancement, there is an increased danger in injuring the outer wall of the ethmoidal labyrinth. While with this small curette a greater number of pulls, and a little more time is required, this is of no importance in comparison with the greater safety of the curettement. Being of so small a size, the cup is placed at an angle of about 60 degrees to the shaft which causes it to take a "better hold."

3. In the operation for opening the antrum of highmore, after removal of the anterior end of the inferior turbinal, and

use of a large trephine as recommended by Freer, the hole thus made is quickly enlarged to a sufficient degree rearward by use of the author's forward cutting nasal punch forceps, and forward by use of Ostrim's forward cutting forceps. In this way while an opening of ample size is quickly made, the edge thereof is of necessity very irregular with projecting points. In order to make this irregular shaped opening smoother the rasp shown is effective. Its concave cutting edge causes it to remain astride



Fig. 3.

the bone as it is pulled forward and pushed backward a few times upon each of the bottom and top edges of the opening. The rear and forward ends of the opening can afterwards be smoothed by pressure with the rasp in combination with an up and down motion of the handle, whereby any roughness of the ends of the opening may be to a large extent effaced. By thus making the bony openings more regular, the wound heals



Fig. 4.

smoothly with no projecting points to interfere with cleansing or to retain future secretions.

4. After completion of the sub-mucous resection of the nasal septum the gauze packer shown in Fig. 4 serves for conveniently introducing strips of gauze made by the Seabury & Johnson Co., being one-half inch in width with woven edges, whereby all fraying of the gauze is avoided. While the first two packings in either nostril had better be strips of absorbant lint, prepared as described in my previous paper (*The Journal of Ophthalmology and Oto-Laryngology*, Oct. and Nov., 1909), and which are best introduced by use of the instrument therein illustrated, the packing is better completed by use of the gauze strips mentioned.



## OBITUARY NOTICES

**Dr. Frank Harcourt Koyle** died in August, at his home on Main street, in Hornell, N. Y., just as the day was drawing to a close.

Dr. Koyle was born at Athens, Canada, forty-six years ago. He graduated from the medical department of Queen's University in Kingston, Ontario. Several years as a successful general practitioner followed in Lowell, Mass., and then Dr. Koyle's keen interest in the eye, ear, nose and throat led him to specialize in the New York hospitals in their care and treatment. After a few years spent in such special practice in Brockville, Dr. Koyle opened an office in Hornell in 1894, and two years later he married Miss Maude McDowell of Penn Yan.

His ability in every detail of his chosen work has been recognized far beyond the usual limits of a practice, and his professional reputation was a source of pride to all Hornell. His keen insight and his dexterity won for him especial prominence. Now, as the result of years of unsparing and uncounted giving of his time, his strength and his vitality, his life, here, has ended at forty-six, but its value and influence will not be lost.

He was a contributor to the advancement of medical science and his writings will be remembered—some of them have been published in *Ophthalmology*.

It is not alone as a physician that Dr. Koyle will be missed by friends without number. His general presence, his social gifts, his rare voice, always at the service of his friends and of every organization which asked his aid, his sweet spirit towards all things and all men, have enabled him to add more to the joy of life than it is often given to one man to do. (*Ophthalmology*.)

**Leartus Conner**, son of Hezekiah and Caroline (Corwin) Connor, was born in Coldenham, Orange County, N. Y., January 29, 1843, and died at his home in Detroit, from cerebral hemorrhage, April 16, 1911. He was a lineal descendant of Jeremiah Connor, who emigrated to America about the middle of the seventeenth century and owned lands in Exeter, N. H., in 1664, and of Matthias Corwin, who emigrated from England and settled in Ipswich, Mass., in 1633.

Dr. Connor was educated in the district schools, in Wallkill Academy and Williams College, graduating a bachelor of arts in 1865 and master of arts in 1868. He then served as assistant principal of Mexico Academy in Mexico, N. Y., for two years; during his leisure time studying the fauna and flora of that region, and medicine with Dr. George Dayton. During 1867-68 he studied in the medical department of the University of Michigan, paying especial attention to practical work in the chemical laboratory. The two years following he spent in the College of Physicians and Surgeons in New York City, taking the degree of M. D. in 1870. During the intervals of his college courses he did practical clinical work, in dispensaries, hospitals and clinics, especially with Dr. Herman Knapp at the Ophthalmic and Aural Institute, and with Dr. Cornelius Agnew at his Manhattan Eye and Ear Hospital. He began practice at Searsville, N. Y., but on February 28, 1871, he removed to Detroit to fill the chair of chemistry and director of the chemical laboratory in the Detroit College of Medicine; in 1872 he was made professor of physiology and clinical medicine; in 1878, professor of diseases of the eye and ear. From 1871 to 1879 he was attending physician to St. Marys' Hospital; from 1881 to 1894, eye and ear surgeon to Harper Hospital, and from 1894 to 1906 consulting eye and ear surgeon; from 1887 to 1910 he was attending eye and ear surgeon to the Children's Free Hospital and consulting eye and



ear surgeon till his death; from 1881 to 1890 he was consulting eye and ear surgeon to the Woman's Hospital.

From 1871 to 1895 Dr. Connor edited a medical journal known at different periods as the *Detroit Review of Medicine and Pharmacy*; *Detroit Medical Journal*, *Detroit Lancet* and the *American Lancet*.

From 1876 to 1883 Dr. Connor was secretary of the American Medical College Association, from 1875 to 1881 secretary of the Detroit Medical College; president of the Detroit Academy of Medicine 1888-89 and 1877-78—its secretary, 1871-72; president of the American Academy of Medicine, 1888-89; president of the American Medical Editors' Association, 1883-84; chairman ophthalmic section of the American Medical Association, 1891; vice-president American Medical Association, 1882-83; trustee of the Journal American Medical Association, 1883-89 and 1892-94.

Dr. Connor was an active member of the Detroit Academy of Medicine; the Wayne County Medical Society; the Michigan State Medical Society; the American Academy of Medicine; the Michigan Academy of Science; the American Medical Association; the American Association for the Advancement of Science; the American Academy of Ophthalmology and Oto-Laryngology and the Detroit Ophthalmological Club.

He was president of the Michigan State Medical Society in 1902-03; chairman of its council, 1902-05. (During this period the profession of Michigan was reorganized and on a scientific basis that greatly increased its efficiency and power.) From 1892 to 1894 he was a member of the committee of the American Medical Association on Revision of its Constitution, By-laws and Code of Ethics.

Among his contributions to ophthalmic literature are "Hot Water in the Management of Eye Diseases," "Optic Neuritis in Its Relations to Cerebral Tumor," "Some Features of Strabismus," "The Technique of Tenotomy of the Ocular Muscles," "Strabismus as a Symptom, Its Causes and Practical Management," "The Causes of Glaucoma," "Diseases of the Lachrymal Passages, Their Causes and Management," "Some Sources of Failure in Treating Lachrymal Obstruction," "The Giant Magnet in Ophthalmic Surgery," "Does Opacity of Incipient Cataract Ever Regain Transparency," and "What Contribution has Vibratory Massage Made to Ophthalmology." (Ophthalmology.)

**Dr. Herman Knapp** died of pneumonia at his country residence at Mamoroneck, N. Y., in his 81st year. For several years previous to his decease he had been in poor health.

The death of Dr. Knapp means the passing of one of America's foremost ophthalmologists, and one who had a great international reputation. Possessed of most robust physique, he used the tremendous energy at his disposal in working in the field of ophthalmology and otology with a tirelessness which was truly marvelous. He was an indefatigable reader and student, a patient investigator and an exceptionally skilled and talented operator. He had admirable judgment in ophthalmological diagnosis and treatment, the result of enormous experience in private, dispensary and hospital practice. He was always ready to impart the knowledge which had contributed so much to his renown and thus attracted, as a teacher, oculists from all parts of the country; his writings invariably excited interest and attention and carried conviction by their directness and positiveness. His operating room was the mecca for visiting colleagues, whose journeys to New York were never thought complete without the good fortune of having seen the great Knapp operate, particularly upon cataract. With all these attainments, he was exceedingly modest, leading a very simple life and finding his chief occupation and pleasure in the duties, work and scientific associations of his special department of medicine.

Herman Knapp was born March 17, 1832, at Dauborn, Germany. He studied medicine at the University of Giessen, where he was graduated in 1854. He then perfected his special knowledge by several years of post-graduate study and work at London, Paris, Berlin and Vienna, and at the end of this period settled in Heidelberg in 1859. Here he qualified as privat-docent the following year, was made professor in 1862 and shortly afterwards founded the University Eye and Ear Hospital, one of the first institutions of this character in Germany, building up a wide reputation as a scientist, practitioner and operator in ophthalmology.

He came to New York in 1869 and founded the New York Ophthalmic and Aural Institute, and about the same time the Archives of Ophthalmology and Otology, published both in German and in English; ten years later this periodical was divided into the Archives of Ophthalmology and the Archives of Otology; the latter journal was discontinued a few years ago, but the former still thrives as one of the best of ophthalmological periodicals and as a monument to the founder. From 1882 to 1888 he occupied the chair of ophthalmology in the medical department of the New York University, and from 1888 to 1902 he held the professorship at the College of Physicians and Surgeons, New York, being made emeritus professor upon his retirement from active teaching in 1903.

Dr. Knapp was the author of a work on "Intra-Ocular Tumors," another on "Cocaine in Ophthalmic Surgery" and wrote the chapters on operation in Norris & Oliver's "System of Diseases of the Eye," besides a number of shorter contributions to the literature of his specialty.

His was an enormously active and successful career in both the scientific and the practical side of ophthalmology, his advice and aid being sought by immense numbers of patients among all classes. Numerous students and former assistants, now practicing in different parts of this country, will gratefully acknowledge the debt they owe and the thorough training for their vocation which they received from him. In recognition of these great obligations, the Section of Ophthalmology of the American Medical Association established the Knapp Testimonial Fund two years ago, the object of which is to encourage original work in ophthalmology and to reward such results with fellowships and prizes. The name which Herman Knapp created will live forever. (Ophthalmology.)

**Albert Rufus Baker.** On April 5, 1911, by the death of Dr. Albert Rufus Baker the community lost a man who played an important part in the professional life and development of the city. Dr. Baker was born in Salem, Pa., in 1858, the son of Benjamin Franklin and Sabina (Pershing) Baker. He graduated from the medical department of Western Reserve University in 1879 and after several years' study abroad, located in Cleveland in 1884, limiting his practice to the eye, ear, nose and throat. He took a keen interest in medical education and all that would tend to elevate the standard of teaching in medical colleges. In 1888 he was appointed professor of ophthalmology, otology and laryngology in the Cleveland College of Physicians and Surgeons (at that time the medical department of Wooster University) and continued in this chair until his death. He was a member of the Association of American Medical Colleges and was its president in 1901; in its deliberations he took an active part and was a faithful attendant at its meetings. He did much to foster medical journalism, and from 1885 to 1896 he was, with Dr. S. W. Kelly, editor of the Cleveland Medical Gazette, and when that journal merged with the Cleveland Journal of Medicine to form the Cleveland Medical Journal he became one of the board of directors and was always ready with suggestion and advice to further the interests of this publication. He was chairman of the ophthalmological section of the American Medical Association in 1893-94.

and had been president of the Cuyahoga County Medical Society. He was a Fellow of the American Academy of Medicine and was a member of the United States Pension Examining Surgeons. He always took a deep interest in civic affairs, especially in regard to the public schools. He was ophthalmologist to St. Alexis and Cleveland General Hospitals, was a frequent contributor to the medical press and highly esteemed in the profession. Dr. Baker was married in 1885 to Miss Emily L. Shackleton, who, with two sons, survive him. (Cleveland Medical Journal, May, 1911.)

**Ovidus Arthur Griffin.** The doctor was a graduate of University of Michigan, Ann Arbor, 1899; formerly demonstrator of ophthalmology and oto-laryngology in his alma mater; a member of the American Association and Academy of Ophthalmology and Oto-Laryngology; examining oculist and aurist to the Washtenaw County (Mich.) U. S. pension examining board; died at his home in Ann Arbor, October 28, from spinal meningitis, aged 39.

**John Fletcher Byington.** The doctor was a graduate of the University of Michigan, Ann Arbor, 1897; a member of the American Medical Association and American Academy of Ophthalmology and Oto-Laryngology; professor of ophthalmology, otology and laryngology in the American Medical Missionary College, Chicago; ophthalmic and aural surgeon to the Battle Creek Sanitarium; died in that institution January 27, from erysipelas, aged 39. (Journal A. M. A., Feb. 11, 1911, p. 439.)

**Frank E. Waxham, M. D.** For many years Dr. Waxham, well known as a laryngologist and rhinologist of Chicago but for several years a resident of Denver, Colo., died in Sugar City, September 4, from cerebral hemorrhage, aged 49. Dr. Waxham was a native of Laporte, Ind., and took his medical course in the Northwestern University, from which he was graduated in 1878. He commenced practice in Chicago and became rapidly prominent as a specialist on diseases of the throat and nose. In 1893, on account of his wife's health, he was obliged to move to Colorado. He settled in Denver, where he was professor of medicine, clinical medicine, laryngology and rhinology, in the University of Colorado, Boulder. He was a member of the American Medical Association and the state medical societies of Illinois and Colorado. He was a member of the medical staff of St. Joseph's Hospital, Denver, laryngologist and rhinologist to the University Hospital, Central Free Dispensary, National Jewish Hospital and Children's Hospital and consulting laryngologist and rhinologist to the Denver City and County Hospital.

**Harry Johnson Dean.** The doctor was a graduate of the Jefferson Medical College, 1890; a member of the American Medical Association and American Academy of Ophthalmology and Oto-Laryngology; eye, ear, nose and throat surgeon to the Hershey Memorial Hospital, Muscatine, Ia.; died at his home in that city, April 26, from nephritis, aged 42. (Jour. A. M. A., May 13, 1911, p. 1408.)

**Gardner Perry Pond.** The doctor was a graduate of the University of California, San Francisco, 1893; a specialist on diseases of the eye, ear, nose and throat of San Francisco for several years, and later a resident of Los Angeles county; formerly a member of the American Medical Association; died at his home in Pasadena, March 19, aged 41, from tuberculosis. (Jour. A. M. A., April 9, 1910, p. 1230.)

**Frederick William Van Slyke.** The doctor was a graduate of the Minnesota Hospital Medical College, Minneapolis, 1883; a member of the American Medical Association; Minnesota Valley Medical Society, American Academy of Ophthalmology and Oto-Laryngology and the Heidelberg (Germany) Ophthalmological Society; ophthalmologist and otologist on the staff of the City and County Hospital, St. Paul, University Free Dispensary and Protestant Orphan Asylum; died in St. Joseph's Hospital, St. Paul, November 23, from gastric ulcer, aged 53. (Jour. A. M. A., Dec. 10, 1910, p. 2077.)

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Brode, Willard.....7 W. Madison St., Chicago, Ill.  
Brodrick, Frank W.....Sterling, Ill.  
\*Brose, L. D.....501 Upper First St., Evansville, Ind.  
Brown, E. J.....39 Syndicate Bldg., Minneapolis, Minn.  
\*Brown, H. H.....31 N. State St., Chicago, Ill.  
Brown, Richard H. M. D.....7 W. Madison St., Chicago, Ill.  
\*Brown, J. E.....239 E. Town St., Columbus, Ohio  
Brown, S. H.....1901 Mt. Vernon St., Philadelphia, Pa.  
Brown, W. Harold.....Edmonton, Alta, Manitoba, Canada  
Bruder, Joseph.....78 W. 114th St., New York, N. Y.  
\*Bruner, Wm. E.....514 New England Bldg., Cleveland, Ohio  
Bryan, W. C.....Linmar Bldg., St. Louis, Mo.  
Bryant, A. G.....416 Marlborough St., Boston, Mass.  
\*Bryant, W. S.....41 E. 33rd St., New York City, N. Y.  
Buckley, J. H.....Fort Smith, Ark.  
Buckman, E. V.....96 S. Franklin St., Wilkesbarre, Pa.  
Buchanan, Mary.....2106 Chestnut St., Philadelphia, Pa.  
Bullard, Wm. L.....Columbus, Ga.  
\*Bulson, Albert E., Jr.....219 W. Wayne St., Ft. Wayne, Ind.  
Burke, Thos. A.....536 Rose Bldg., Cleveland, Ohio  
\*Burrell, H. L.....15th and Dodge Sts., Omaha, Neb.  
Burrows, L., Jr.....482 Franklin St., Buffalo, N. Y.  
Busch, F. E.....155 Lowry Bldg., St. Paul, Minn.  
Butt, M. M.....1701 Chestnut St., Philadelphia, Pa.  
Caffey, Hugh B.....412 N. Broadway, Pittsburg, Kas.  
Calhoun, F. P.....833 Candler Bldg., Atlanta, Ga.  
Callan, Peter A.....35 W. 38th St., New York City, N. Y.  
Campbell, W. H.....19 W. 7th St., Cincinnati, Ohio  
\*Campbell, Don M.....57 W. Fort St., Detroit, Mich.  
Carmody, T. E.....520 Metropolitan Bldg., Denver, Colo.  
Carney, A. C.....111 N. Third St., Hamilton, Ohio  
Carr, George W.....30 S. Franklin St., Wilkesbarre, Pa.  
Carroll, Frank.....Cedar Rapids, Iowa  
Carson, Geo. R.....212 W. Market St., Pottsville, Pa.  
Carter, W. W.....69 W. 50th St., New York City, N. Y.  
Case, Geo. M.....Elmira, N. Y.  
\*Casselberry, Wm. E.....15 E. Washington St., Chicago, Ill.  
\*Chamberlain, J. W.....Lowry Arcade, St. Paul, Minn.  
Chase, John.....Jackson Bldg., Denver, Colo.  
\*Cheatham, Wm.....303 W. Chestnut St., Louisville, Ky.  
Cheney, F. E.....126 Commonwealth Ave., Boston, Mass.  
Claiborne, John H.....34 W. 36th St., New York City, N. Y.  
\*Cline, Lewis.....224 N. Meridian St., Indianapolis, Ind.  
Cochman, Robert W.....Madison, Ind.  
Cogan, Jas. E.....707 Rose Bldg., Cleveland, Ohio  
Cohen, Martin.....34 E. 58th St., New York City  
Collins, E. W.....600 California Bldg., Denver, Colo.  
Conboy, Phillip.....109 East Ave., Rochester, N. Y.  
Connor, Ray.....703 Washington Arcade, Detroit, Mich.  
Coover, David H.....305 California Bldg., Denver, Colo.  
Corser, John B.....345 Wyoming Ave., Scranton, Pa.  
Cott, Geo. F.....85 N. Pearl St., Buffalo, N. Y.  
Coulton, Charles F.....Wadena, Minn.  
Coursolles, Newbold.....42 Prince Arthur Ave., Toronto, Canada  
Craig, Alex R.....535 N. Dearborn Ave., Chicago, Ill.  
Cramer, A. J.....218 N. Fifth St., Camden, N. J.  
Crary, A. W.....Boone, Ia.  
Craton, S. B.....700 University Bldg., Syracuse, N. Y.  
Creighton, W. J.....1905 Chestnut St., Philadelphia, Pa.  
Creveling, H. C.....214-215 Humboldt Bldg., St. Louis, Mo.  
\*Crocker, F. S.....31 N. State St., Chicago, Ill.  
Croskey, J. W.....3325 Powelton Ave., Philadelphia, Pa.  
\*Culbertson, L. R.....Zanesville, Ohio  
Curry, Robert S.....Columbus, Miss.  
Dabney, S. G.....216 W. Chestnut St., Louisville, Ky.  
Dabney, Wm. R.....Marietta, Ohio  
Davis, A. E.....50 W. 37th St., New York City  
Davis, Francis W.....408 Broadway, Cincinnati, Ohio  
Davis, J. Leslie.....1700 Walnut St., Philadelphia, Pa.  
Day, E. W.....Pittsburgh, Pa.  
\*Dayton, W. L.....Lincoln, Neb.  
\*Dean, F. W.....214 Merriam Bldg., Council Bluffs, Ia.  
\*Dean, L. W.....Iowa City, Ia.  
Dennis, D. N.....9th and Peach Sts., Erie, Pa.  
Dennis, Frank L.....501 N. Tejon St., Colorado Springs, Colo.  
\*DeSchweinitz, Geo.....1705 Walnut St., Philadelphia, Pa.



- DeVilbiss, Allen.....1220 Jackson Ave., Toledo, Ohio  
 Dickinson, B. M.....6200 Penn Ave., Pittsburgh, Pa.  
 \*Dietrich, W. A.....7th and Cherry Sts., Chattanooga, Tenn.  
 Dixon, Geo. Sloan.....123 E. 74th St., New York City, N. Y.  
 Doane, L. Leo.....Butler, Pa.  
 \*Dodd, Oscar.....31 N. State St., Chicago, Ill.  
 \*Donovan, J. A.....Butte, Mont.  
 \*Dorsey, J. G.....105 Douglas Ave., Wichita, Kas.  
 \*Dowling, Oscar.....1-3 Cooper Bldg., Shreveport, La.  
 Dressei, Gustav.....1103 Head Bldg., San Francisco, Cal.  
 \*Duane, Alexander.....139 E. 37th St., New York City, N. Y.  
 Duckworth, Guilford M.....Pine Bluff, Ark.  
 Dudley, Wm. H.....640 H. W. Hellman Bldg., Los Angeles, Cal.  
 Duncan, Adelaide.....31 N. State St., Chicago, Ill.  
 Dunn, Ira J.....810 Peach St., Erie, Pa.  
 \*Dunn, Oscar B.....Ironton, Ohio  
 Dwyer, W. M.....99 Grove St., Amsterdam, N. Y.  
 Eastman, Henry.....1104 Park Bldg., Pittsburgh, Pa.  
 Easton, John C.....85 E. High St., Springfield, Ohio  
 Ellett, Ed. C.....Memphis, Tenn.  
 Ellis, H. Bert.....Los Angeles, Cal.  
 Emerson, Linn.....Orange, N. J.  
 Enfield, Chas.....Jefferson, Ia.  
 Engle, H. P.....200 Olive St., Newton, Ia.  
 \*Esterly, D. E.....735 Kansas Ave., Topeka, Kas.  
 \*Evans, C. S.....Union City, Ind.  
 Evensen, Harold O.....Ottawa, Ill.  
 \*Ewing, U. B. G.....Kollenberg Annex Bldg., Richmond, Ind.  
 \*Faith, Thomas.....31 N. State St., Chicago, Ill.  
 Farrel, P. J. F.....32 N. State St., Chicago, Ill.  
 Farrington, Pope H.....Randolph Bldg., Memphis, Tenn.  
 Feingold, Marcus.....124 Baroune St., New Orleans, La.  
 Ferguson, Edmund S.....India Temple, Oklahoma City, Okla.  
 Fernandez, Francisco M.....Prado 105, Havana, Cuba  
 \*Ferris, Edgar.....New Castle, Ind.  
 Finerty, John J.....429 Franklin St., Buffalo, N. Y.  
 Fish, H. Manning.....Heyworth Bldg., Chicago, Ill.  
 \*Fisher, Wm. A.....31 N. State St., Chicago, Ill.  
 \*Fiske, Geo. F.....32 N. State St., Chicago, Ill.  
 Fitzpatrick, T. V.....32 Garfield Pl., Cincinnati, Ohio  
 Flagg, John D.....384 Franklin St., Buffalo, N. Y.  
 Fleming, E. W.....924 Trust & Sav'gs Bldg., 6th & Spring Sts., Los Angeles, Cal.  
 Fletcher, John R.....32 N. State St., Chicago, Ill.  
 Forsyth, Edgar A.....322 Franklin St., Buffalo, N. Y.  
 Foster, E. Edwin.....271 Union St., New Bedford, Mass.  
 \*Foster, Hal.....11th and Walnut Sts., Kansas City, Mo.  
 Foster, John McEwen.....11 Stedman Bldg., Denver, Colo.  
 Foster, Matthias L.....211 Centre Ave., New Rochelle, N. Y.  
 Fowler, Edmond P.....57 W. 76th St., New York City, N. Y.  
 Fowler, I. R.....508-10 Carleton Bldg., St. Louis, Mo.  
 \*Fox, L. Webster.....1304 Walnut St., Philadelphia, Pa.  
 \*Francis, Lee Masten.....575 Delaware Ave., Buffalo, N. Y.  
 Frank, Ira.....15 E. Washington St., Chicago, Ill.  
 Franklin, W. S.....Butler Bldg., San Francisco, Cal.  
 Frederick, M. W.....2152 Sutter St., San Francisco, Cal.  
 Freeman, E. D.....Osgood, Ind.  
 French, Royal T.....Tremont Bldg., Marshalltown, Ia.  
 \*Freudenthal, Wolff.....1003 Madison Ave., New York City, N. Y.  
 Frey, C. L.....Scranton, Pa.  
 \*Friedenberg, P. H.....60 E. 58th St., New York City, N. Y.  
 Friedenwald, Harry.....1029 Madison Ave., Baltimore, Md.  
 Friedman, David.....808 West End Ave., New York  
 Fringer, W. R.....William Brown Bldg., Rockford, Ill.  
 Gallaher, T. J.....605 California Bldg., Denver, Colo.  
 Garber, Jerry M.....Mansfield, Ohio  
 Garraghan, E. F.....31 N. State St., Chicago, Ill.  
 Geiger, C. W.....Kankakee, Ill.  
 Gifford, Harold.....15th and Douglas Sts., Omaha, Neb.  
 Gilbert, Frank Y.....Portland, Me.  
 Givens, L. S.....Cynthiana, Ky.  
 Gleason, E. B.....2033 Chestnut St., Philadelphia, Pa.  
 Glogau, Otto.....1184 Lexington Ave., New York, N. Y.  
 \*Goldstein, M. A.....3858 Westminster Pl., St. Louis, Mo.  
 Good, R. H.....278 Ashland Ave., River Forest, Ill.  
 Gorrell, Talbot J.....93 Illinois St., Chicago Heights, Ill.  
 \*Goux, L. J.....60 Washington Ave., Detroit, Mich.  
 Gradle, Harry S.....32 N. State St., Chicago, Ill.  
 Grant, J. George.....Central Savings & Trust Bldg., Akron, Ohio  
 \*Greene, D. W.....19 Perry St., North Dayton, Ohio  
 Green, John, Jr.....1625 Metropolitan Bldg., St. Louis, Mo.  
 Griffith, B. B.....Vincennes, Ind.  
 Grim, Ulysses J.....31 N. State St., Chicago, Ill.  
 Grosvenor, L. N.....34 Washington St., Chicago, Ill.

Hadley, James W.	Frankfort, Ind.
Hager, Walter A.	103 Lafayette St., South Bend, Ind.
Hagler, A. L.	The Hagler Bldg., Springfield, Ill.
*Hägler, Elmer E.	The Hägler Bldg., Springfield, Ill.
Hague, D. W.	Springfield, Ohio
Hall, G. C.	Gaulbert Bldg., Louisville, Ky.
Hamilton, E. E.	Wichita, Kas.
Hansell, Howard F.	1521 Walnut St., Philadelphia, Pa.
Harkness, Gordon F.	3rd and Brady Sts., Davenport, Ia.
Harper, J. E.	1101 Masonic Temple, Chicago, Ill.
Harris, Clarence M.	Johnstown, Pa.
Harris, H. B.	Dayton, Ohio
Harris, W. C.	7th and Race Sts., Cincinnati, Ohio
Hartsock, Fred M.	U. S. Army, Fort Mayne, Detroit, Mich.
*Hartz, H. J.	27 E. Adams St., Detroit, Mich.
Hartzell, Sol. M.	Dollar Bank Bldg., Youngstown, Ohio
Harvey, N. D.	114 Waterman St., Providence, R. I.
Hatch, C. B.	13 W. Church St., Newark, Ohio
*Hawley, Geo. F.	31 N. State St., Chicago, Ill.
Hayden, A. A.	32 N. State St., Chicago, Ill.
Hayman, Edward C.	Grand Island, Neb.
Hays, Harold N.	11 W. 81st St., New York City, N. Y.
Hays, Samuel B.	Atherton Bldg., Louisville, Ky.
Haughey, Wilfred A. M., M. D.	Battle Creek, Mich.
*Head, Gustavus P.	32 N. State St., Chicago, Ill.
Heath, Fred C.	Newton Claypool Bldg., Indianapolis, Ind.
Heard, Mary K.	24 N. Clinton St., Iowa City, Ia.
*Heckel, E. B.	Jenkins Bldg., Pittsburgh, Pa.
Heckler, Frank A.	Columbus, Ohio
Heed, Chas. Rittenhouse	1700 Walnut St., Philadelphia, Pa.
Heitger, Jos. D.	Heitger Bldg., Bedford, Ind.
Held, Ruben J.	616 Madison Ave., New York
Henderson, Frank L.	Humboldt Bldg., St. Louis, Mo.
Henning, Carl.	The Rochambeau, Washington, D. C.
Hess, Wm. L.	400 California Bldg., Denver, Colo.
Hetzel, Clarence Chas.	218½ Third St., Davenport, Ia.
Hibbard, W. E.	307 E. Colorado St., Pasadena, Cal.
Hickey, Preston N.	32 W. Adams St., Detroit, Mich.
Higgins, Samuel G.	Milwaukee, Wis.
Hill, Arthur J.	Canton, Ohio
Hilliard, Walter.	1415 Welton St., Denver, Colo.
Hinnen, G. A.	8-10 E. 8th St., Cincinnati, Ohio
Hitz, H. B.	121 Wisconsin St., Milwaukee, Wis.
*Hoffman, J. R.	31 N. State St., Chicago, Ill.
Hogue, Gustavus I.	105 Grand Ave., Milwaukee, Wis.
*Holinger, J.	64 W. Randolph St., Chicago, Ill.
*Holmes, Christian R.	8-10 E. Eighth St., Cincinnati, Ohio
*Hood, Thomas C.	Willoughby Bldg., Indianapolis, Ind.
Hopkins, W. E.	836 Turk St., San Francisco, Cal.
Hosmer, Chas. M.	Colorado Springs, Colo.
Howard, Jos. W.	805 McGee St., Kansas City, Mo.
*Howe, Lucien.	183 Delaware Ave., Buffalo, N. Y.
Hubbard, Albert E.	372 Franklin St., Buffalo, N. Y.
Hubby, Lester M.	27 W. 68th St., New York City, N. Y.
Huizinga, J. A.	Grand Rapids, Mich.
Hunt, Harry E.	496 Endicott Arcade, St. Paul, Minn.
Hunter, Dwight W.	80 W. 40th St., New York City, N. Y.
Hurd, Lee M.	15 E. 48th St., New York City, N. Y.
Hussey, A. E.	14 E. 7th St., Cincinnati, Ohio
Iglauer, Samuel.	22 W. 7th St., Cincinnati, Ohio
Imperator, Chas. J.	245 W. 102nd St., New York City, N. Y.
Ingerman, Lergius M.	1843 Madison Ave., New York City, N. Y.
Ingersoll, J. M.	318 Euclid Ave., Cleveland, Ohio
Irwin, Frank Newton.	10 W. 39th St., New York City, N. Y.
Irwin, Vincent J.	351 Main St., Springfield, Mass.
Ivins, Harry M.	704 Security Bank Bldg., Cedar Rapids, Ia.
*Jackson, Chevalier.	428 Park Bldg., Pittsburgh, Pa.
*Jackson, Edward.	Metropolitan Bldg., Denver, Colo.
Jacobi, Frank.	416-18 Colton Bldg., Toledo, Ohio
Jacoby, Douglas P. A.	Newport, R. I.
*James-James, J. A.	1006 Carleton Bldg., St. Louis, Mo.
James, John H.	Mankato, Minn.
*Jamison, T. H.	Wellington, Kas.
Jarecky, Herman.	138 W. 86th St., New York City, N. Y.
Jay, Milton Y.	Portland, Jay Co., Ind.
Jervey, Wilkinson.	Bank of Commerce Bldg., Greenville, S. C.
Jennings, J. E.	509 Carleton Bldg., St. Louis, Mo.
Jobson, G. B.	Franklin, Pa.
Johnston, Richard Hall.	919 N. Charles St., Baltimore, Md.
Johnston, J. E.	204 S. Washington St., Marion, Ind.
*Johnson, J. H.	105 W. Eighth St., Coffeyville, Kas.
Kaufman, A. Spencer.	1429 Spruce St., Philadelphia, Pa.
*Keiper, Geo. F.	La Fayette, Ind.

Keith, Darwin M.	414 N. Main St., Rockford, Ill.
*Keller, T. F.	The Spitzer, Toledo, Ohio
Keller, W. S.	63-64 Groton Bldg., Cincinnati, Ohio
Kelley, S. G.	Sedalia, Mo.
Kerrison, P. D.	58 W. 56th St., New York City, N. Y.
Kincaid, John H.	421 W. Church Ave., Knoxville, Tenn.
King, Geo. L.	P. O. Bldg., Alliance, Ohio
Kirkendall, John S.	Ithaca, N. Y.
*Kirkpatrick, Samuel	915 Alabama St., Selma, Ala.
Kiser, J. D.	Lexington, Ky.
Kleene, Frederick	801 Milwaukee Ave., Chicago, Ill.
Klinedinst, J. Ferd.	25 S. George St., York, Pa.
Klopp, E. L.	8th and Oak Lane, Philadelphia, Pa.
Knapp, Arnold	10 E. 54th St., New York City, N. Y.
Knapp, A. J.	320 E. Maine St., Evansville, Ind.
Knapp, Bleeker	Evansville, Ind.
Knapp, Geo.	4th and Broadway, Vincennes, Ind.
Knipe, Jay C.	2035 Chestnut St., Philadelphia, Pa.
Koeler, J. C.	4059 Spruce St., Philadelphia, Pa.
Kollock, Chas. Wilson	Charleston, S. C.
Kopetzky, S. J.	616 Madison Ave., New York City, N. Y.
Krauss, Frederick	1701 Chestnut St., Philadelphia, Pa.
Kress, Palmer J.	24 S. 7th St., Allentown, Pa.
Krug, E. F.	12 W. 44th St., New York City, N. Y.
Kruger, Geo. M.	4804 Central Ave., Madisonville, Ohio
*Kyle, J. J.	N. Claypool Bldg., Indianapolis, Ind.
La Force, Bert D.	Ottumwa, Ia.
La Force, E. F.	Burlington, Ia.
Lamb, F. W.	4 W. 7th St., Cincinnati, Ohio
Lamb, Robert S.	The Cecil, Washington, D. C.
Landman, Louis H.	14 E. 7th St., Cincinnati, Ohio
Langworthy, Henry Glover	Temple Hall, Dubuque, Ia.
*Lapsley, R. M.	Y. M. C. A. Bldg., Keokuk, Ia.
*Large, S. H.	536 Rose Bldg., Cleveland, Ohio
Lauder, Clark H.	Grinnell, Ia.
Lauder, Edward	1021 Prospect St., Cleveland, Ohio
Layman, D. W.	212 Newton Claypool Bldg., Indianapolis, Ind.
League, Rufus J.	Durham, N. C.
*Ledbetter, S. L.	2027 Third Ave., Birmingham, Ala.
*Lederman, Isaac	423 W. Chestnut St., Louisville, Ky.
Lenker, John N.	275 Prospect St., Cleveland, Ohio
*Levy, Robt.	Metropolitan Bldg., Denver, Colo.
*Lewis, E. R.	1258 Main St., Dubuque, Ia.
*Lewis, F. Park	454 Franklin St., Buffalo, N. Y.
*Lewis, Geo. G.	Syracuse, N. Y.
Lewis, R. H.	217 N. Wilmington, Raleigh, N. C.
Libby, George F.	530 Metropolitan Bldg., Denver, Colo.
Lichtenberg, J. S.	1208 Wyandott St., Kansas City, Mo.
Linhart, Christopher P.	106 E. Broad St., Columbus, Ohio
Littig, J. V.	412 Lane Bldg., Davenport, Ia.
Livingstone, P. J.	307 Fine Arts Bldg., Detroit, Mich.
*Lockard, L. B.	1427 Stout St., Denver, Colo.
*Loeb, Hanau	3539 Olive St., St. Louis, Mo.
Lohey, H. M.	833 Candler Bldg., Atlanta, Ga.
Loring, J. B.	31 N. State St., Chicago, Ill.
Louchery, Daniel C.	212 W. Main St., Clarksburg, W. Va.
Love, J. King	42 N. 2nd St., Easton, Pa.
Lukens, Chas.	218 Michigan St., Toledo, Ohio
Madden, P. R.	Xenia, Ohio
Magee, Robert S.	913 Kansas Ave., Topeka, Kas.
Maire, L. E.	203 Park Bldg., Detroit, Mich.
Marple, Wilbur B.	46 W. 53rd St., New York City, N. Y.
Martin, H. H.	247 Bull St., Savannah, Ga.
Martin, Wm. A.	San Francisco, Cal.
Marquis, Geo. P.	31 N. State St., Chicago, Ill.
*Masters, J. L.	249 N. Pennsylvania St., Indianapolis, Ind.
Mather, Elmer L.	Everett Bldg., Akron, Ohio
Matthews, Justus	Rochester, Minn.
Mauldin, Leland O.	Greenville, S. C.
Maumenee, A. E.	Mobile, Ala.
May, Chas. Henry	698 Madison Ave., New York City, N. Y.
*Mayer, Emil	40 E. 41st St., New York City, N. Y.
McAllister, J. C.	Ridgway, Pa.
McCaskey, Carl H.	600 Amer. Cent. Life Bldg., Indianapolis, Ind.
McCoal, Joseph	1212 Spruce St., Philadelphia, Pa.
McCoy, John	157 W. 53rd St., New York City, N. Y.
McKee, S. H.	249 Mountain St., Montreal, Canada
*McKernon, J. F.	62 W. 52nd St., New York City, N. Y.
McKinney, Richmond	Memphis Trust Bldg., Memphis, Tenn.
*McReynolds, J. O.	Trust Bldg., Dallas, Tex.
*Means, C. S.	715 N. High St., Columbus, Ohio
Meierhof, Edward L.	1140 Madison Ave., New York City, N. Y.
Merrill, Wm. Howe	Bay State Bldg., Lawrence, Mass.

Metzenbaum, Myron.....	768 Rose Bldg., Cleveland, Ohio
Mial, L. L.....	23 W. 36th St., New York City, N. Y.
Amick, W. T.....	Memphis, Tenn.
Middleton, A. B.....	Pontiac, Ill.
Miles, H. S.....	417 State St., Bridgeport, Conn.
Miller, Cleton M.....	217 E. Grace St., Richmond, Va.
Millette, John W.....	210 Ribold Bldg., Dayton, Ohio
*Miner, S. G.....	6 Miner Bldg., Detroit, Mich.
*Minor, Chas. L.....	9½ E. Main St., Springfield, Ohio
Mithoefer, Wm.....	22 W. 7th St., Cincinnati, Ohio
*Mittendorf, Wm. F.....	141 Madison Ave., New York City, N. Y.
Monosmith, O. B.....	314 Broadway, Lorain, Ohio
Moore, Mead.....	The Rochambeau, Washington, D. C.
Monson, S. H.....	466 Lenox Bldg., Cleveland, Ohio
*Moore, T. W.....	Huntington, W. Va.
Morgan, C. D.....	McClain Bldg., E. State St., Columbus, Ohio
Mortimer, W. Golden.....	40 E. 25th St., New York City, N. Y.
Morrison, Frank A.....	The Willoughby, 224 N. Meridian St., Indianapolis, Ind.
*Mott, John S.....	1225 Rialto Bldg., Kansas City, Mo.
Mundt, G. H.....	6300 Halsted St., Chicago, Ill.
Murphy, Frank G.....	Mason City, Ia.
*Murphy, J. W.....	4 W. 7th St., Cincinnati, Ohio
Murphy, W. E.....	628 Elm St., Cincinnati, Ohio
*Murray, W. R.....	510 Pillsbury Bldg., Minneapolis, Minn.
*Nance, Willis O.....	32 N. State St., Chicago, Ill.
Neeper, Ed. R.....	46 P. O. Bldg., Colorado Springs, Colo.
Newcomb, John R.....	217 Newton Claypool Bldg., Indianapolis, Ind.
Newhart, Horace.....	502 Pillsbury Bldg., Minneapolis, Minn.
Norris, Sam'l C.....	1016 Meridian St., Anderson, Ind.
Noyes, Guy L.....	Columbia, Mo.
*Nye, F. T.....	Beloit, Wis.
Oatman, Edmond LeRoy.....	32 Remsen St., Brooklyn, N. Y.
Oberg, Carl M.....	201 Globe Bldg., Minneapolis, Minn.
Odell, Anna.....	32 Adams Ave., Detroit, Mich.
Offutt, N. N.....	Lexington, Ky.
Oppenheimer, Seymour.....	45 E. 60th St., New York City, N. Y.
O'Reilly, Chas. A.....	1806 Chestnut St., Philadelphia, Pa.
Outwater, Sam'l.....	8th & Main Sts., Riverside, Cal.
Overman, Fred V.....	224 N. Meridian St., Indianapolis, Ind.
Owens, Chas. K.....	Diamond Bank Bldg., Pittsburg, Pa.
*Owen, F. S.....	209 Karback Bldg., Omaha, Neb.
*Page, Lafayette.....	224 N. Meridian St., Indianapolis, Ind.
Park, John Walter.....	32 N. 2d St., Harrisburg, Pa.
*Parker, Walter.....	912 Chamber of Com., Detroit, Mich.
Patterson, James A.....	309 N. Tejon St., Colorado Springs, Colo.
Patton, James M.....	567 Brandeis Bldg., Omaha, Neb.
Payne, A. L.....	Eau Claire, Wis.
Payne, S. M.....	542 Fifth Ave., New York City, N. Y.
Pearson, W. W.....	417 Equit. Bldg., Des Moines, Iowa
*Pendleton, F. M.....	Fifth & Hampshire Sts., Quincy, Ill.
Peters, Walter H.....	606 Columbia St., Lafayette, Ind.
Pfafflin, Chas. A.....	Newton Claypool Bldg., Indianapolis, Ind.
Pfister, F.....	Majestic Bldg., Milwaukee, Wis.
*Phillips, Frank A.....	32 N. State St., Chicago, Ill.
Phillips, W. C.....	40 W. 47th St., New York City
Phinney, Frank D.....	22 W. 7th St., Cincinnati, Ohio
Pollock, Harry L.....	209 S. State St., Chicago, Ill.
Pontius, Paul J.....	1831 Chestnut St., Philadelphia, Pa.
Posey, Wm. C.....	1835 Chestnut St., Philadelphia, Pa.
Potts, John B.....	567 Brandies Bldg., Omaha, Neb.
Pratt, John A.....	232-33 Coulter Block, Aurora, Ill.
Price, Norman W.....	Niagara Falls, N. Y.
*Prince, Arthur E.....	628 Capitol Ave., Springfield, Ill.
Pyfer, Howard.....	Norristown, Pa.
*Pyncheon, Edwin.....	31 N. State St., Chicago, Ill.
Ranly, John.....	936 Clark St., Cincinnati, Ohio
Ravdin, Marcus.....	223 Main St., Evansville, Ind.
*Ray, J. M.....	423 W. Chestnut St., Louisville, Ky.
*Ray, Victor.....	7th & Race St., Groton Bldg., Cincinnati, Ohio
*Reber, Wendell.....	1212 Spruce St., Philadelphia, Pa.
Reese, R. G.....	147 W. 57th St., New York City, N. Y.
*Reeve, A. R.....	48 Bloor St., Toronto, Canada
Reger, H. S.....	Johnstown, Pa.
Reik, Henry O.....	412 Cathedral St., Baltimore, Md.
*Remmen, Nils.....	31 N. State St., Chicago, Ill.
*Renner, W. S.....	361 Pearl St., Buffalo, N. Y.
Reynolds, H. G.....	115 S. 6th St., Paducah, Ky.
*Reynolds, Indley.....	315 & 316 Norton Bldg., Louisville, Ky.
Rhoads, J. Neely.....	1635 S. Broad St., Philadelphia, Pa.
*Richardson, Chas. W.....	1317 Connecticut Ave. N. W., Washington, D. C.
*Rideout, W. J.....	Freeport, Ill.
Ringenberg, Eugene.....	Lockport, N. Y.
Ringle, Chas. A.....	Greeley, Colo.



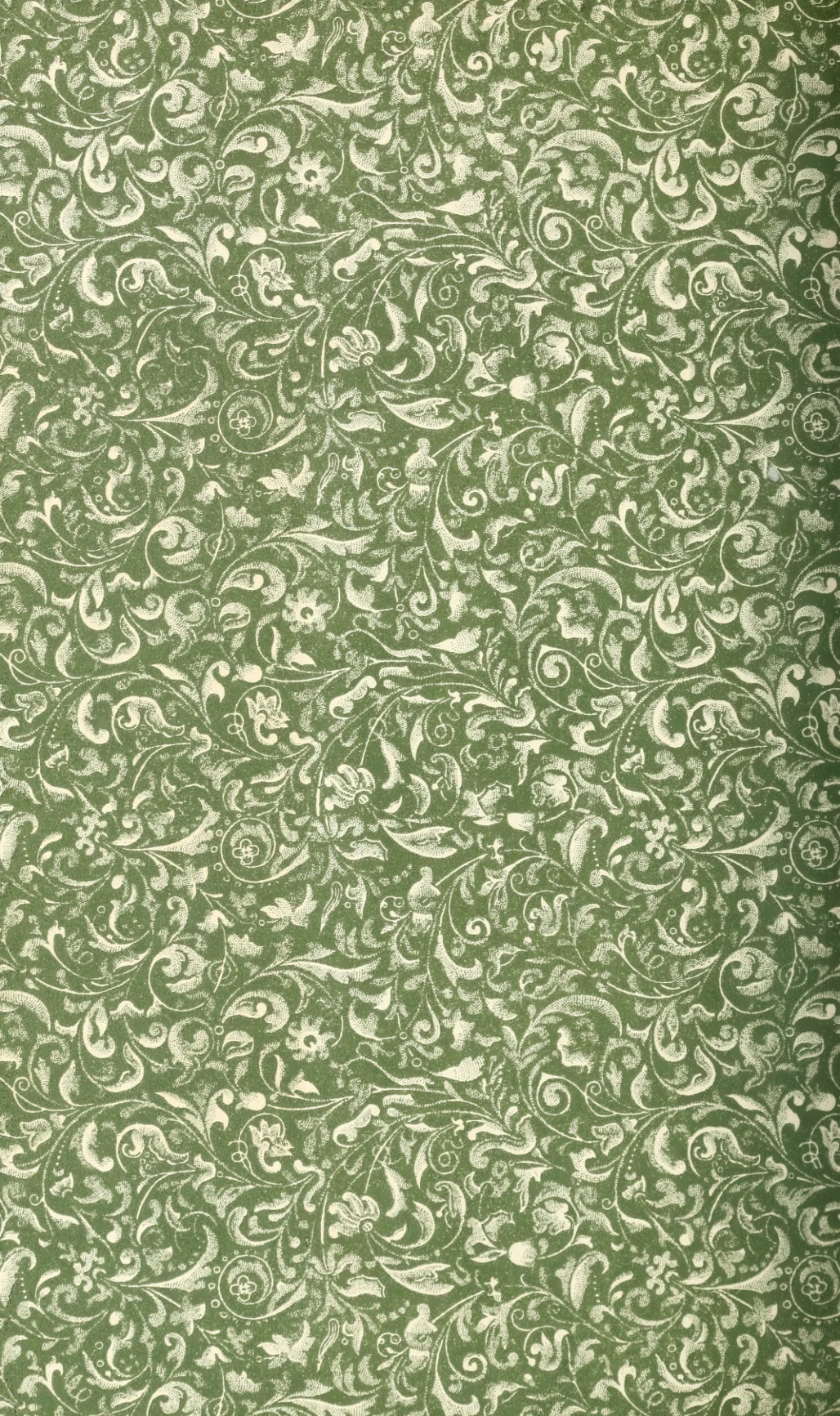
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*Woodruff, Thomas A.....	7 W. Madison St., Chicago, Ill.
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Wylar, J. S.....	Groton Bldg., Cincinnati, Ohio
Wylie, Chas. B.....	Bates Blk., 20½ W. 9th St., Chattanooga, Tenn.
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